RESTRICTED

PILOT TRAINING MANUAL FOR THE

B-25

REVISED 1 APRIL, 1945

THIS REVISED EDITION SUPERSEDES THE ORIGINAL (GRAY COVERED) PILOT TRAINING MANUAL FOR THE B-25.

ALL COPIES OF THE LATTER ARE RESCINDED.

AAF Manual No. 50-11

Pilot Training Manual for the Mitchell Bomber

B-25

REVISED 1 APRIL, 1945

PUBLISHED FOR HEADQUARTERS, AAF

OFFICE OF ASSISTANT CHIEF OF AIR STAFF, TRAINING

BY HEADQUARTERS, AAF, OFFICE OF FLYING SAFETY

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Foreword

This manual is the text for your training as a B-25 pilot and airplane commander.

The Air Forces' most experienced training and supervisory personnel have collaborated to make it a complete exposition of what your pilot duties are, how each will be performed, and why it must be performed in the manner prescribed.

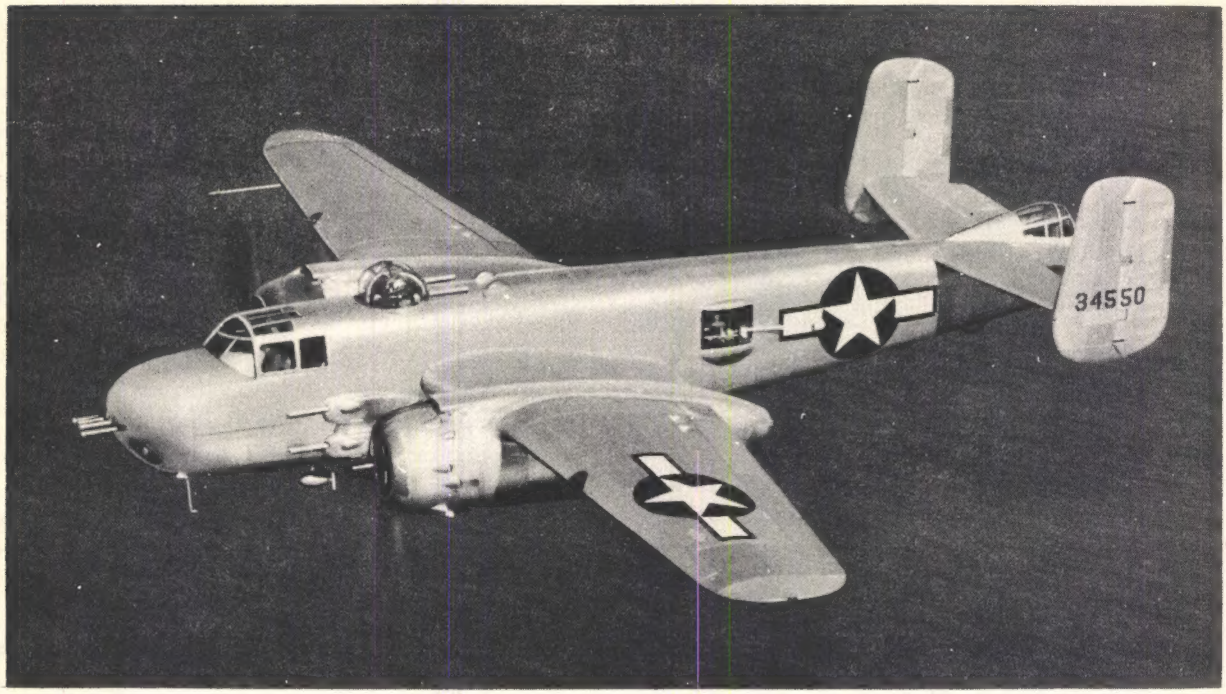
The techniques and procedures described in this book are standard and mandatory. In this respect the manual serves the dual purpose of a training checklist and working handbook. Use it to make sure that you learn everything described herein. Use it to study and review the essential facts concerning everything taught. Such additional self-study and review will not only advance your training, but will alleviate the burden of your already overburdened instructors.

This training manual does not replace the Technical Orders for the airplane, which will always be your primary source of information concerning the B-25 so long as you fly it. This is essentially the textbook of the B-25. Used properly, it will enable you to utilize the pertinent Technical Orders to even greater advantage.

COMMANDING GENERAL, ARMY AIR FORCES

Additional copies of this manual should be requested from:

HEADQUARTERS AAF, OFFICE OF FLYING SAFETY, SAFETY EDUCATION DIVISION, Winston-Salem 1, North Carolina.



HISTORY OF THE MITCHELL BOMBER B-25

Welcome to the Mitchell bomber!

You are going to fly a champ with a long line of firsts to her credit!

First to see action on every fighting front.

First Army airplane to sink an enemy sub.

First medium bomber to fly from a carrier deck.

First warplane to pack a 75-mm. cannon.

It all started when the Army asked for designs of a medium bomber to be submitted. That was on 25 January, 1939. Forty days later the B-25 was born!

Daughter of a slide rule, with neither wind-tunnel tests nor prototypes to study, the performance of the B-25 was a series of figures on an engineer's drawing board.

Yet, 19 days after Hitler marched into Poland, in September, 1939, the Army awarded the North American Aviation Company a contract for 148 Mitchell bombers, one of the largest orders written up to that time.

In less than 2 months, following a number of modifications, the mock-up was approved. Exhaustive tests by Army engineers followed, and in August, 1940, the first B-25 was test-flown and its performance found to be better than the claims its designers had made for it.

Since that time, hundreds of changes in design have been made, but the general appearance of all models of the B-25 has not changed.

Designed to carry a bomb load of 3500 lb. and a crew of 5, it has operated efficiently with heavier bomb loads and a crew of 6. Early in the war, when it was engaged in emergency evacuation work, the B-25 carried 26 men and their baggage a distance of 700 miles. On one occasion it carried 32 men and their baggage with auxiliary and main fuel cells full.

Red-lined at 340 mph, cruising easily at 200 mph, the Mitchell, when emergencies have arisen, has exceeded 340 mph, with no disastrous effects.

Its low landing speed has been a boon to flyers who have had to operate from jungle strips and airfields blasted from mountain sides.

Combat experience led to changes in design and armament — more firepower, spare fuel tanks, power-driven turrets, and larger escape hatches, which were added to meet the need for quick exit from a damaged plane.

In April, 1942, the Mitchell made history. Under the leadership of Brigadier General Ralph Royce and Colonel John Davies, 13 B-25's set out from an unidentified base for the island of Mindanao, 2000 miles away. On this, the longest bombing expedition in the history of aerial warfare, the planes flew 2000 miles to a secret base where a store of gasoline was hidden. For 2 days they hit the Japs who were advancing on Bataan, then headed for home without loss.

Less than a week later came the Doolittle raid on Tokyo, with 16 B-25's taking off from the deck of the aircraft carrier Hornet. It can now be told that the tail guns in the B-25's on that raid were painted broomsticks which Major General Doolittle ordered installed after learning that Jap pilots had been ordered to stay out of range of the American tail-stingers.

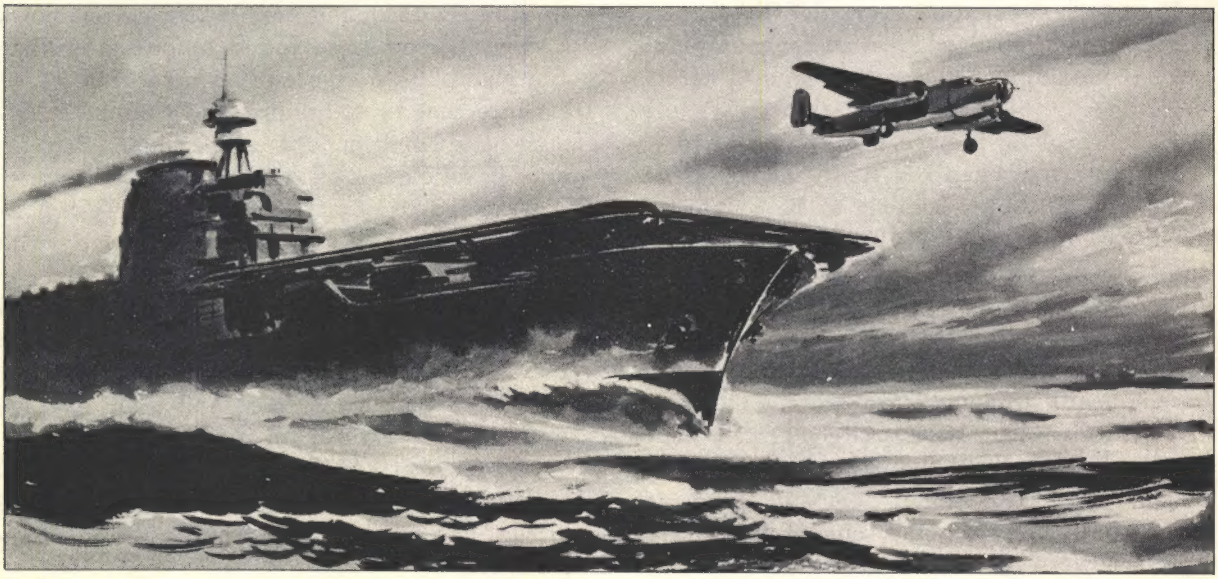
During the early days of the submarine menace, B-25's were equipped with special wing bomb racks, operating successfully in the submarine hunt and again proving their versatility and capacity for modification.

Arctic operation meant new problems in heating and defrosting for the B-25. They were overcome. Long over-water hops, with hours of precision instrument flying, brought the installation of the automatic pilot, taking the strain off our flyers. For action against the Jap navy, torpedo racks were installed. A multitude of combat problems found the B-25 ready for adaptation to meet them, its most recent and spectacular adaptation being the installation of the 75-mm. cannon in the B-25 G and B-25 H.

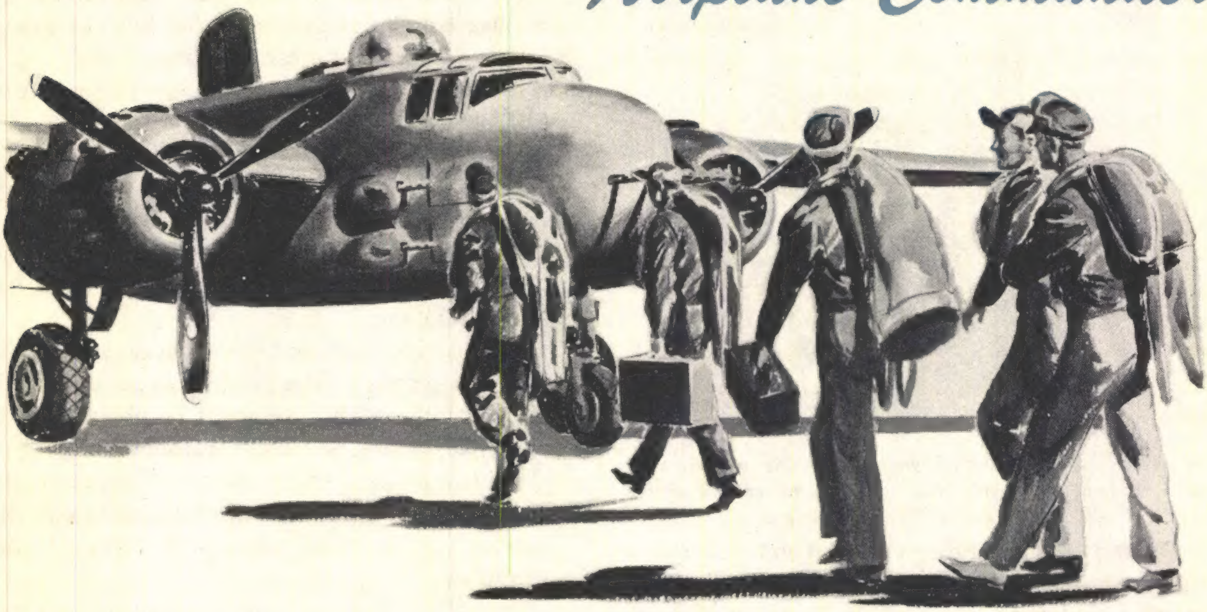
The use of the B-25 as a low-altitude attack plane led to the removal of the lower turret. It was replaced by .50-cal. waist guns and a power-operated tail turret. For more effective defense, the upper turret was moved forward.

Package guns—two .50-cal. mounted on each side of the fuselage and firing forward—plus four .50-cal. installed in the nose above the cannon, have transformed the B-25 into a flying machine-gun company, superbly effective for strafing.

The evolution of the Mitchell bomber does not end here. Every day, as experience mounts and new tactics develop, the B-25 proves its versatility, ready to run with the hare or hunt with the hounds—an airplane of which its pilots may well say: It does the job!



DUTIES AND RESPONSIBILITIES OF THE *Airplane Commander*



The commander of the B-25 must be more than a pilot. As his title implies, he must be a leader of men—a leader in a special sense. He must not train his crew as automatons, but as a team which will use initiative and perform its tasks to one end only . . . the success of the mission.

You are the leader. The successful coordination of the work involved in getting your plane to its objective and back to its base depends a great deal on the way in which you lead.

When you are thoroughly familiar with the jobs the members of your crew are doing, you've won half the battle of being the commander of your airplane.

The second half of the battle consists in knowing your men as individuals as well as members of the crew. Do you know where your tail gunner was born? Is your crew chief married? What work was your navigator doing before he got in the Army? How does your bombardier like his job on the B-25?

If you're going about things the right way, you may never have to ask. Men always talk about themselves when they're fairly sure their listener is really interested.

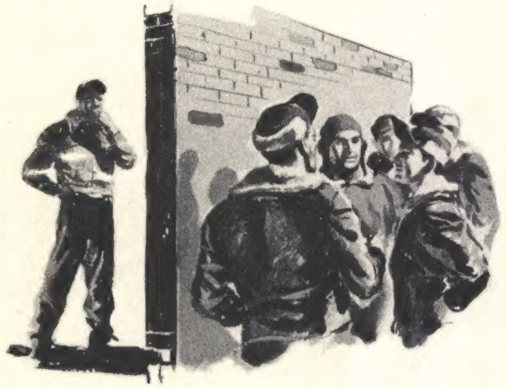
They'll know whether you're interested if you look out for their comfort on flights and between flights. If you're away from base overnight, you may find it necessary to finance one crew member or another. Be sure that every crew member is properly fed, quartered, and clothed. The manner in which you take care of their needs will make or mar your reputation with your crew.

Your best rule of thumb for getting to know and take care of your crew should go something like this: "Is my interest in the crew getting the best out of them for the teamwork I need to fly my plane?"

Crew Discipline

Discipline in an air crew means that you are commanding respect and getting your orders obeyed. It also means that a lot of the time you're not finding it necessary to give orders at all. Your crew members are performing their duties without having to be told.

A good way to develop the jitters about your plane and your crew is by keeping them at a distance, talking to them pompously, and by showing favoritism or uncertainty in your decisions.



In a little while you'll find yourself working on one side of a 10-foot wall while your crew works on the other.

On the other hand, you won't get discipline by dropping all distinctions between commander and crew and letting the waist gunner call you Joe.

Somewhere between these two methods there is a happy medium which will insure that any order you give will bring instant obedience and maintain respect and mutual confidence.

You can be friendly without becoming familiar, understanding without becoming a father-confessor, and firm without emulating Simon Legree. Give direct orders only when there is a need for orders. Once you issue an order, **see that it is always obeyed.**

THE COPILOT

The copilot is the executive officer—your chief assistant, understudy, and strong right arm. He must be familiar enough with every one of your duties—both as pilot and as airplane commander—to take over and act in your place at any time.

He must be able to fly the airplane under all conditions as well as you would fly it yourself.

He must be proficient in engine operation and know instinctively what to do to keep the airplane flying smoothly, even though he is not handling the controls.

He must have a thorough knowledge of cruising control data and know how to apply his knowledge at the proper time.

He is also the engineering officer aboard the airplane, and maintains a complete log of performance data.

He must be able to fly good formation in any assigned position, day or night.

He must be qualified to navigate by day or at night by pilotage, dead reckoning, and by use of radio aids.

He must be proficient in the operation of all radio equipment in the pilot's compartment.

In formation flying, he must be able to make engine adjustments almost automatically.

He must be prepared to assist on instruments when the formation is climbing through an overcast, so you can watch the rest of the formation.

Remember that the more proficient your copilot is **as a pilot,** the better able he is to perform the duties of the vital post he holds as your second in command.

Be sure that he is always allowed to do his share of the flying, in the copilot's seat, on takeoffs, landings, and on instruments.

Bear in mind that the pilot in the right-hand seat of your airplane is preparing himself for an airplane commander's post too. Allow him every chance to develop his ability and to profit by your experience.

PILOT-COPILOT PROCEDURE

Flying most modern multi-engine airplanes is a big job, too big for one man to do efficiently. So flying duties are divided among the members of your crew. Every crew member must know his duties and execute them properly to fly safely.

Obviously you cannot make **every** flight with the same crew. Therefore it is necessary to teach all crews the same general procedures. Your copilot must know what you expect of him. You in turn must know what you **can** expect of him even though it is your first flight together.

PILOT DUTIES

The pilot actually handling the controls is responsible for:

1. The airplane and its crew
2. Proper inspections and checks
3. Hand and oral signals
4. Proper maneuvering of the airplane
5. Proper operation of the engines and auxiliary equipment.

COPILOT DUTIES

The pilot not actually handling the controls must:

1. Read the required checklists.
2. Raise, lower, and check the position of the landing gear on orders from the pilot.
3. Guard the throttles to prevent creeping on takeoff.
4. Operate prop controls to keep a safe relation between rpm and manifold pressure as the pilot operates the throttles. (This is very important in formation flying.)
5. Check radio equipment before the flight. Make all routine radio contacts correctly and at the proper time, without prompting.
6. Check engine instruments and maintain proper operating limits.
7. Aid the pilot in emergencies.

Confusion in the Cockpit

Accident records show clearly that many accidents are caused by confusion. Pilots, in the middle of the takeoff run, have found themselves sliding along the runway with the gear retracted. Other pilots have made beautiful belly landings with both pilot and copilot positive the gear was down and locked until the prop started scraping the runway.

Get it straight—**know what your flying partner is doing.** The cockpit of an airplane is a poor place for guesswork.

Hand Signals

When you want the gear raised after takeoff, execute this hand signal **slowly and distinctly.** Call "Gear Up."

Use this signal to lower the wheels for landing. Call "Gear Down."

When the gear is fully down or up have the copilot call "Gear Up" or "Gear Down." Both pilot and copilot must check the gear visually.

Be just as deliberate and clear every time you give an order or issue instructions to your crew. Make each crew member repeat any instructions you give him over the interphone. This is the only way you can prevent misunderstandings and careless mistakes.

Note: On dual rides with an instructor pilot in either seat you will perform both pilot and copilot duties.

THE BOMBARDIER-NAVIGATOR

As a navigator it is the bombardier-navigator's job to direct your flight from departure to destination and return. He must know the exact position of the airplane at all times. For you to understand how to get the most reliable service from your navigator, you must know as much about his job as possible.

Navigation is the art of determining geographic positions by means of (a) pilotage, (b) dead reckoning, (c) radio, or (d) celestial navigation, or any combination of these four methods. By any one or combination of methods the navigator determines the position of the airplane in relation to the earth.

Instrument Calibration

Instrument calibration is an important duty of the navigator. All navigation depends directly on the accuracy of his instruments. Correct

calibration requires close cooperation and extremely careful flying by the pilot. Instruments to be calibrated include the altimeter, all compasses, airspeed indicators, alignment of the astrocompass, astrograph, and drift meter, and a check on the navigator's sextant and watch.

Pilot-Navigator Preflight Planning

1. Pilot and navigator must study the flight plan of the route to be flown, and select alternate airfields.
2. Study the weather with the navigator. Know what weather you are likely to encounter. Decide what action is to be taken. Know the weather conditions at the alternate fields.
3. Inform your navigator at what airspeed and altitude you wish to fly so that he can prepare his flight plan.
4. Learn what type of navigation the navigator intends to use: pilotage, dead reckoning, radio, celestial, or a combination of all methods.
5. Determine check points; plan to make radio fixes.
6. Work out an effective communication method with your navigator to be used in flight.

Pilot-Navigator in Flight

1. **Constant course**—For accurate navigation you must fly a constant course. The navigator has to make many computations and entries in his log. Constantly changing course makes his job more difficult. A good navigator should be able to follow the pilot, but he cannot be taking compass readings all the time.
2. **Constant airspeed**—Hold IAS as nearly constant as possible. This is as important to the navigator as is a constant course in determining position.
3. **Precision flying** greatly affects the accuracy of the navigator's instrument readings, particularly celestial readings. A slight error in celestial reading causes considerable error in determining position. You can help the navigator by providing as steady a platform as possible from which to take readings. The navigator should notify you when he intends to take readings so that you can level off and fly as smoothly as possible, preferably by using the automatic pilot. Do not allow your navigator to be disturbed while he is taking celestial readings.
4. **Notify the navigator of any change in flight**, such as change in altitude, course, or airspeed. Before you change your flight plan, consult the navigator. Talk over the proposed change so that he can plan the flight and advise you concerning it.
5. If there is doubt about the position of the airplane, consult your navigator, refer to his flight log, talk the problem over and decide together the best course of action.

6. Check your compasses at intervals with those of the navigator, noting any deviation.

7. Require your navigator to give position reports at intervals.

8. You are ultimately responsible for getting the airplane to its destination. Therefore, it is your duty to know your position at all times.

9. Encourage your navigator to use as many of the methods of navigation as possible for double-checking. In training, give him a chance to practice. Follow his courses even though you know he is wrong. Keep track of the plane's position but allow him to rectify his errors.

Post-flight Critique

After every flight, go over the navigator's log. If there have been serious navigational errors determine their cause. If the navigator is at fault, caution him that it is his job to see that the same mistake does not occur again. If faulty instruments have caused the error, see that they are corrected before attempting another navigation mission. If your flying has contributed to the inaccuracy of the navigation, try to fly a better course the next mission.

Miscellaneous Duties

As a member of the team, the bombardier-navigator must also have a general knowledge of the entire operation of the airplane.

He is the armament officer, and the fire control officer, for your crew.

He must know how to operate the turrets, radio equipment, and fuel transfer system.

He must know the location of all fuses and spare fuses, lights and spare lights.

He must be familiar with emergency procedures, such as the manual operation of landing gear, bomb bay doors, and flaps, and the proper procedures for crash landings, ditching, bailout, etc.

Bombardment

Accurate and effective bombing is the ultimate purpose of your entire airplane and crew. Every other function is preparatory to hitting and destroying the target.

Successful bombardment is the primary goal of the bombardier-navigator. The success or failure of the mission depends upon what he accomplishes in that short interval of the bombing run.

A great deal depends on the understanding between bombardier-navigator and pilot. You expect your bombardier to know his job. He expects you to understand the problems involved in his job, and to give him full co-operation. Teamwork between pilot and bombardier is essential.

Under any given set of conditions—ground speed, altitude, direction, etc.—there is only one point in space where a bomb may be released from the airplane to hit a predetermined object on the ground.

Unless the pilot performs his part of the bombing run correctly, even the best bombardier in the world cannot bomb accurately.

There are many things with which a bombardier must be thoroughly familiar in order to release his bombs at the right point to hit this predetermined target.

He must understand his bombsight, what it does, and how it does it.

He must understand the operation and upkeep of his bombing instruments and equipment.

He must know that his racks, switches, controls, releases, doors, linkage, etc., are in first-class operating condition.

He must know how to operate all gun positions in the airplane.

He must know how to load and how to clear simple gun stoppages and jams while in flight.

He must be able to load and fuse bombs.

He must understand the destructive power of bombs and know the vulnerable spots on various types of targets.

He must understand the bombing problem, bombing probabilities, bombing errors, etc.

He must be versed in target identification and in aircraft identification.

The bombardier should be familiar with the duties of all members of the crew.

To enable the bombardier to do his job, you must place the airplane in the proper position to arrive at a point from which he can release his bombs to hit the target.

RADIO OPERATOR

There is a lot of radio equipment in today's B-25's. There is one particular man who is supposed to know all there is to know about this equipment. Sometimes he does, but often he doesn't. His deficiencies often do not become apparent until the crew is in the combat zone when it is too late. Too often pilots and crews lose their lives because the radio operator has accepted his responsibility indifferently.

It is impossible to learn radio in a day. It is imperative that you check your radio operator's ability to handle his job before taking him overseas as part of your crew. To do this you may have to check with the various instructors to find out any weakness in the radio operator's training and proficiency and to help overcome such weaknesses.

The radio operator is required to:

1. Render position reports every 30 minutes.
2. Assist the navigator in taking fixes.
3. Keep the liaison and command sets properly tuned and in good operating order.
4. Understand from an operational point of view:
   (a) Instrument Landing
   (b) IFF
   (c) VHF
   and other navigational aids.
5. Maintain a log.

In addition to being radio operator, the radio man is also a gunner. During combat he leaves his watch at the radio and takes up his guns.

He is an invaluable aid in navigating your plane. Get him to show you how he and his radio equipment can assist both you and your bombardier-navigator.

He often has to learn photography. Some of the best pictures taken in the Southwest Pacific were taken by radio operators.

Note

The employment of radar has led to many innovations in the radio field. This means constant study on your part to keep abreast of the latest developments. Quite often that little extra knowledge may mean the difference between success or failure of your mission.

THE ENGINEER

Size up the man who is to be your engineer. This man should know more about the airplane you are to fly than any other member of the crew. If there are deficiencies in his training you may be able to fill them in.

Think back on your own training. In many courses of instruction, you had a lot of things thrown at you from right and left. You had to concentrate on how to fly; where your equipment was concerned, you learned to rely more and more on the enlisted men, particularly the crew chief and the engineer, for advice.

Pilot and engineer must work closely together to supplement and fill in the blank spaces in each other's education.

To be a qualified combat engineer, a man must know his airplane, his engines, and his armament equipment thoroughly.

He must work closely with the copilot, checking engine operation, fuel consumption, and the operation of all equipment.

He must be able to work with the bombardier, and know how to cock, lock, and load the bomb racks. It is up to you to see that he is familiar with these duties and, if he is hazy concerning them, to have the bombardier give him special help and instruction.

He should have a general knowledge of radio equipment, and be able to assist in tuning transmitters and receivers.

Your engineer should be your chief source of information about the airplane. He should know more about the equipment than any other member of the crew—yourself included.

You, in turn, are his source of information about flying. Bear this in mind in all your discussions with the engineer. The more complete you can make his knowledge of the reasons behind every function of the equipment, the more valuable he will be as a member of the crew. Someday his extra knowledge may save the day in an emergency.

Generally, in emergencies, the engineer is the man to whom you turn first. Build up his pride, his confidence, his knowledge. Know him personally; check on the extent of his knowledge.

THE GUNNERS

Your gunners belong to one of two distinct categories: turret gunners and flexible gunners.

The power turret gunners must have good coordination.

While the flexible gunners do not require the same delicate touch as the turret gunner, they must have a fine sense of timing.

All gunners should be familiar with the coverage area of all gun positions, and be prepared to bring the proper gun to bear on the target.

They must be experts in aircraft identification.

They must be thoroughly familiar with the machine guns. They should know how to maintain the guns, how to clear jams and stoppages, and how to harmonize the sights with the guns.

During training flights, the gunners should be in their turrets, tracking with the guns even when actual firing is not practicable. Other aircraft flying in the vicinity offer excellent tracking targets, as do automobiles, houses, and other ground objects during low-altitude flights.

Keep your gunners' interest alive at all times. Any form of competition among the gunners themselves should stimulate their interest.

Finally, each gunner should fire the guns at each station to familiarize himself with the other positions.

Rules to Be Enforced on Every Flight

Smoking

Smoking is prohibited under the following conditions at all stations, in all aircraft.

1. During all ground operation.
2. During and immediately after takeoff.
3. During fuel transfer operations.
4. Immediately before and during landings.
5. In the bomb bay and fuselage which at any time contains auxiliary gas tanks.
6. At any time any occupant detects gas fumes.
7. When prohibited by local directives.

Parachutes

All occupants will be equipped with parachutes on all flights.

Pilot must:

1. See that a parachute is available, assigned, properly fitted, and located near each person.
2. Know that occupants are familiar with the operation of parachutes.
3. See that occupants know the location and operation of escape hatches.
4. See that occupants know and understand the emergency signal and bailout signal.

Oxygen

Oxygen will be used:

1. At 10,000 feet and above on all flights.
2. From the ground up on all tactical and combat flights at night.
3. Between 8,000 and 10,000 feet on all flights of 4 hours or greater duration.

Propellers

1. Always enter and leave the plane to and from the rear.
2. No person will leave the airplane when propellers are turning unless ordered to do so by the airplane commander.

Training

1. Tell your crew the purpose of each mission and what you expect each to accomplish.
2. **Keep the crew busy throughout the flight.** Get position reports from the navigator; send them out through the radio operator. Put the engineer to work on the cruise control and maximum range charts. Require the copilot to keep a record of engine performance. Give them a workout. Encourage them to use their skill. A team is an active outfit. Make the most of every practice mission.
3. **Practice all emergency procedures as often as possible—bailout, ditching and fire drill.**

Inspections

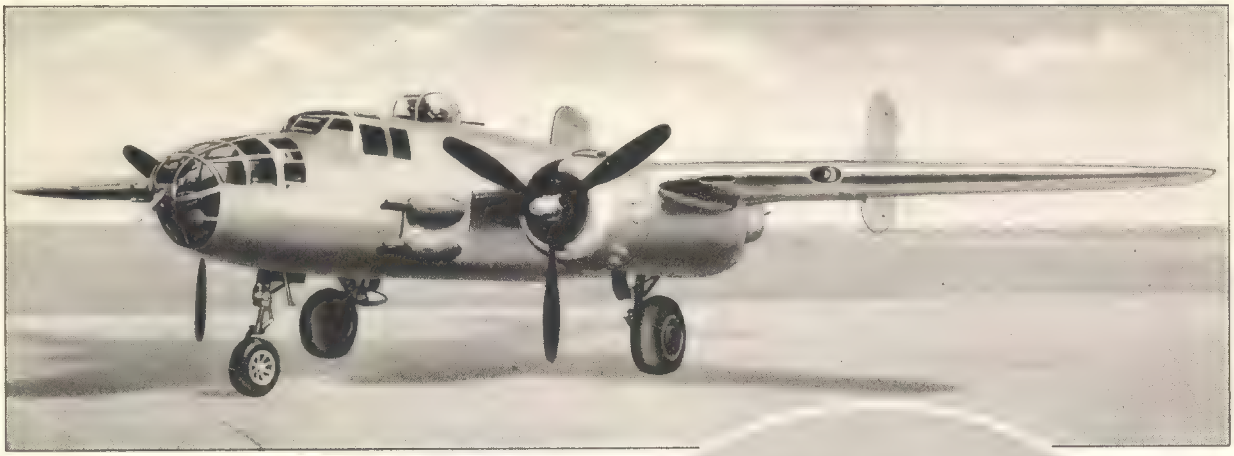
1. Check your airplane with reference to the particular mission you are undertaking. **Check everything.**
2. Check your crew for equipment, preparedness, and understanding of what you expect from them.

Interphone

1. Assure yourself that all members of the crew are standing by their interphones at all times. **Insist on clear, well-controlled voices. Speak slowly and clearly.**
2. Require interphone reports from all crew members at regular intervals, when on oxygen.

GENERAL DESCRIPTION

★ The Mitchell medium bomber is a high-speed, mid-wing land monoplane. Positive dihedral in the inner and negative dihedral in the outer wing panels give the plane a gull-wing appearance, while adding control and maneuverability. ★ A twin tail section with large rudders increases stability and maneuverability and allows a greater concentration of firepower to the rear.



Size

Span. . . . . .67 ft. 7 in.

Length. . . . . .53 ft. 5¾ in.

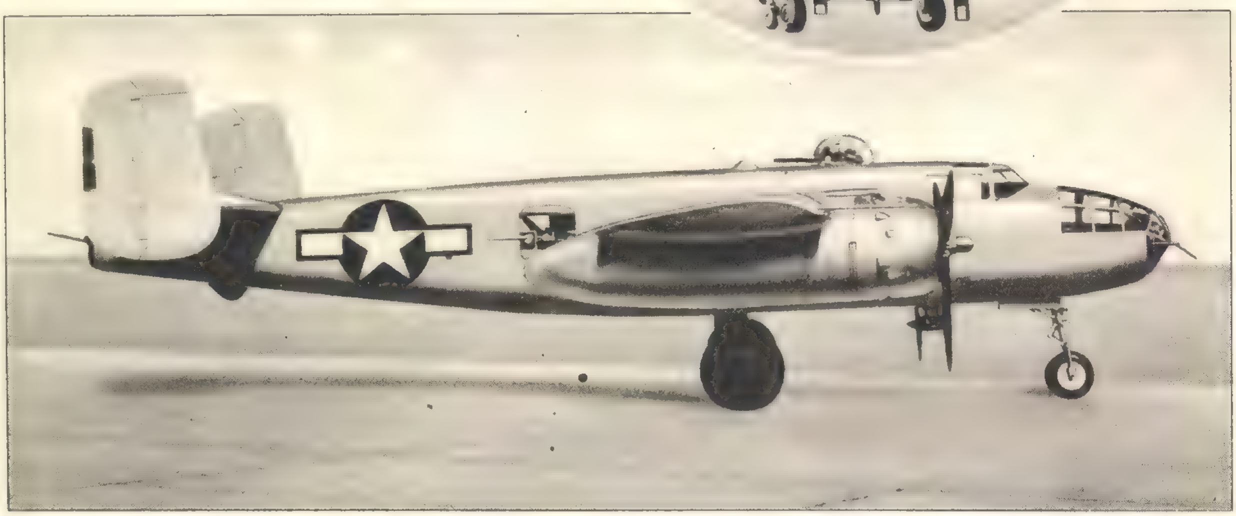
Height. . . . . .16 ft. 4 3/16 in.

Weight

Empty. . Approximately 20,300 lbs.

Maximum Gross . . . . . .36,000 lbs.

Maximum Landing . . . .32,300 lbs.



A tricycle landing gear adds to the ease of landing, prevents groundlooping, and provides the pilot with maximum visibility during ground operation. It also permits a wide range of loading to obtain maximum bomb and weight carrying capacity.

Underslung Wright Cyclone engines drive Hamilton hydromatic propellers and deliver 1700 Hp each at full power.

The fuselage is a semi-monocoque, four-longeron, stressed skin structure. The bombardier's, pilot's, and navigator's compartments are located in that order, forward of the bomb bay. The radio operator's, gunner's, and photographer's compartments are located in that order aft of the bomb bay.

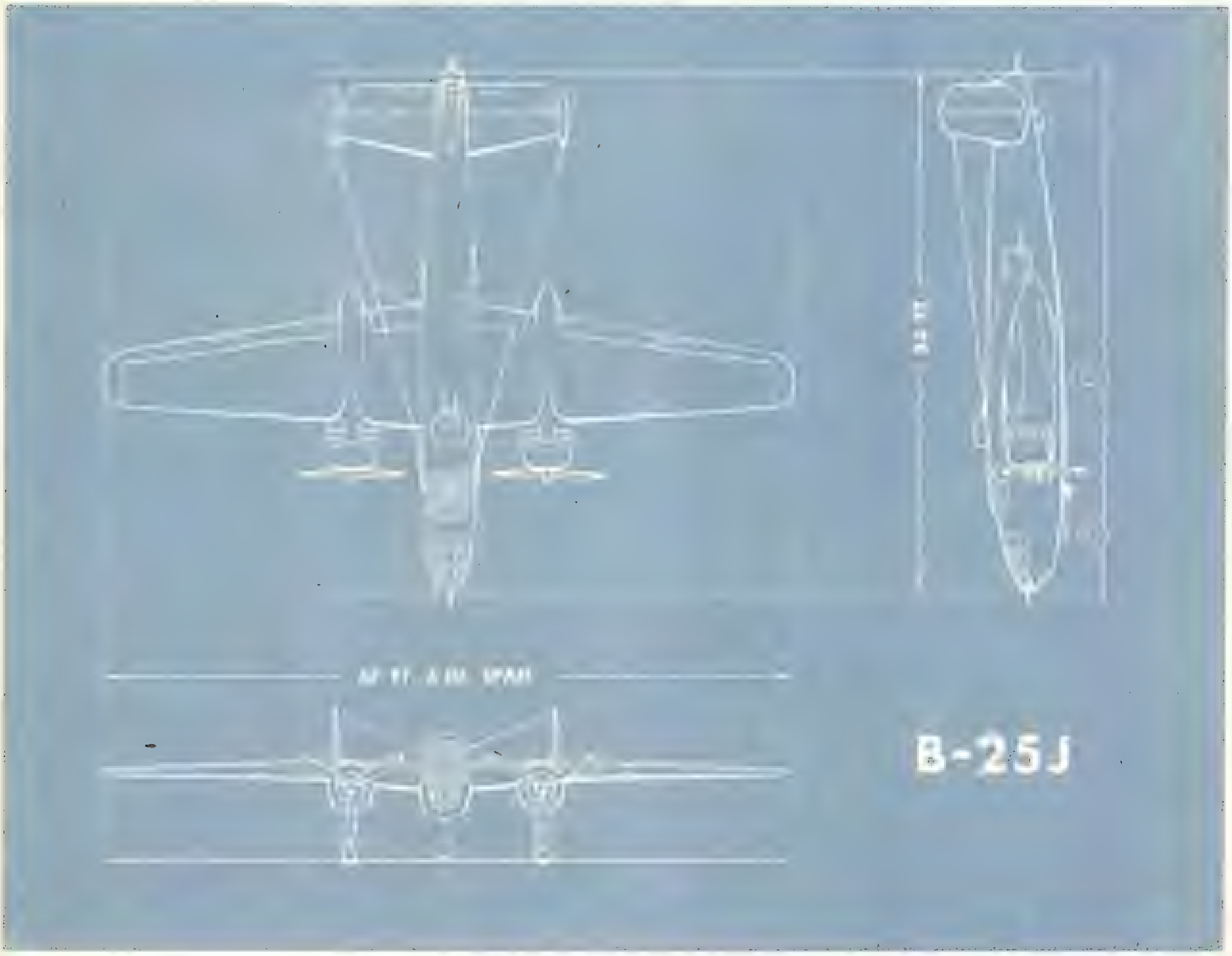
Each engine has individual self-sealing fuel and oil systems. Fuel transfer systems allow extra fuel, carried in fuselage tanks, to be transfered to the main system. There is a crossfeed in the fuel system for emergency operations.

Two 24-volt batteries supply electric power for starting and initial operation. Two generators recharge the batteries and supply power when engine speed permits their operation. Each engine has a dual-ignition system.

The B-25 has standard communication and bombardment equipment. Its armament is varied but follows AAF standards. Models of the plane have been converted for varying tactical needs by the addition of .50-cal. machine guns and the 75-mm. cannon.

There are electrically driven power turrets on some models and a hydraulically driven tail turret on others.

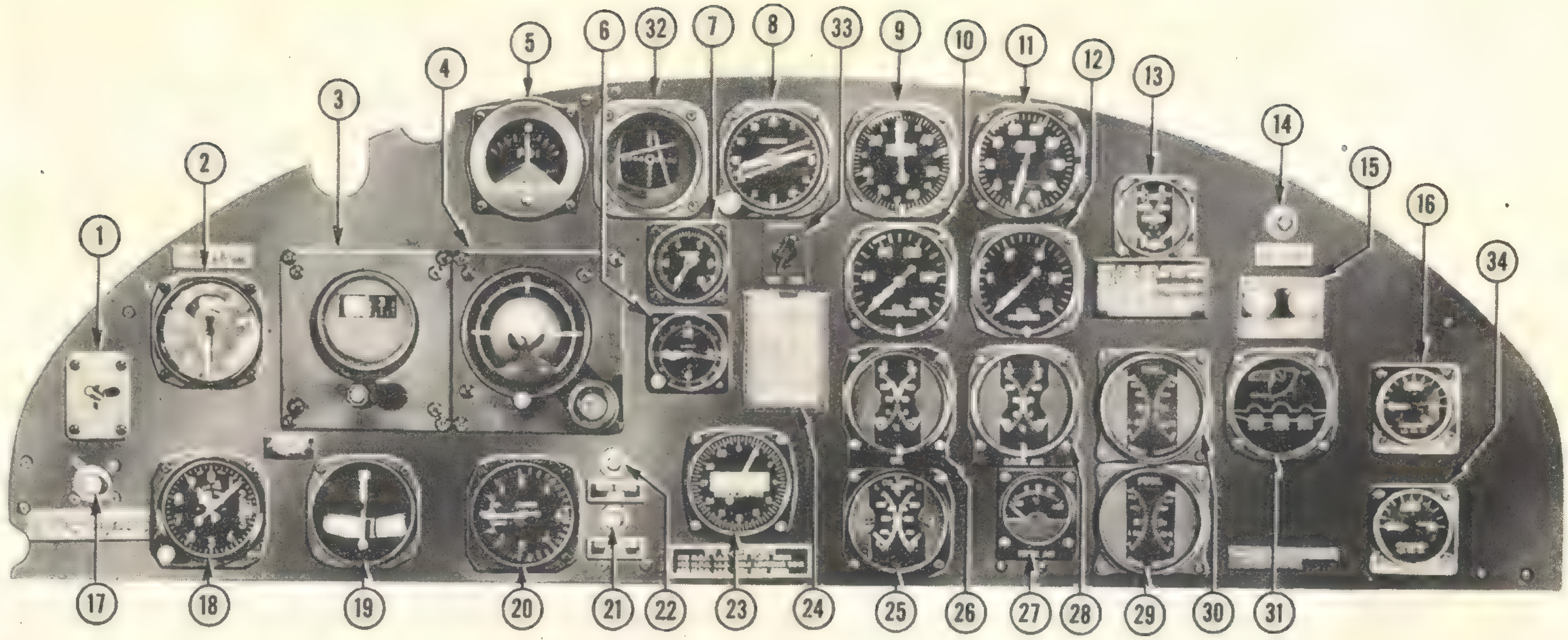
The plane has standard lighting, heating and hydraulic systems.



LOCATION OF CONTROLS

BOMBARDIER'S COMPARTMENT—LEFT SIDE

1. Windshield Wiper Motor
2. Defroster Tee
3. Bomb Interval Control
4. Bombardier's Instrument Panel
5. Bomb Control Panel
6. Bomb Chart Holder
7. Warning Horn
8. Bomb Release Switch

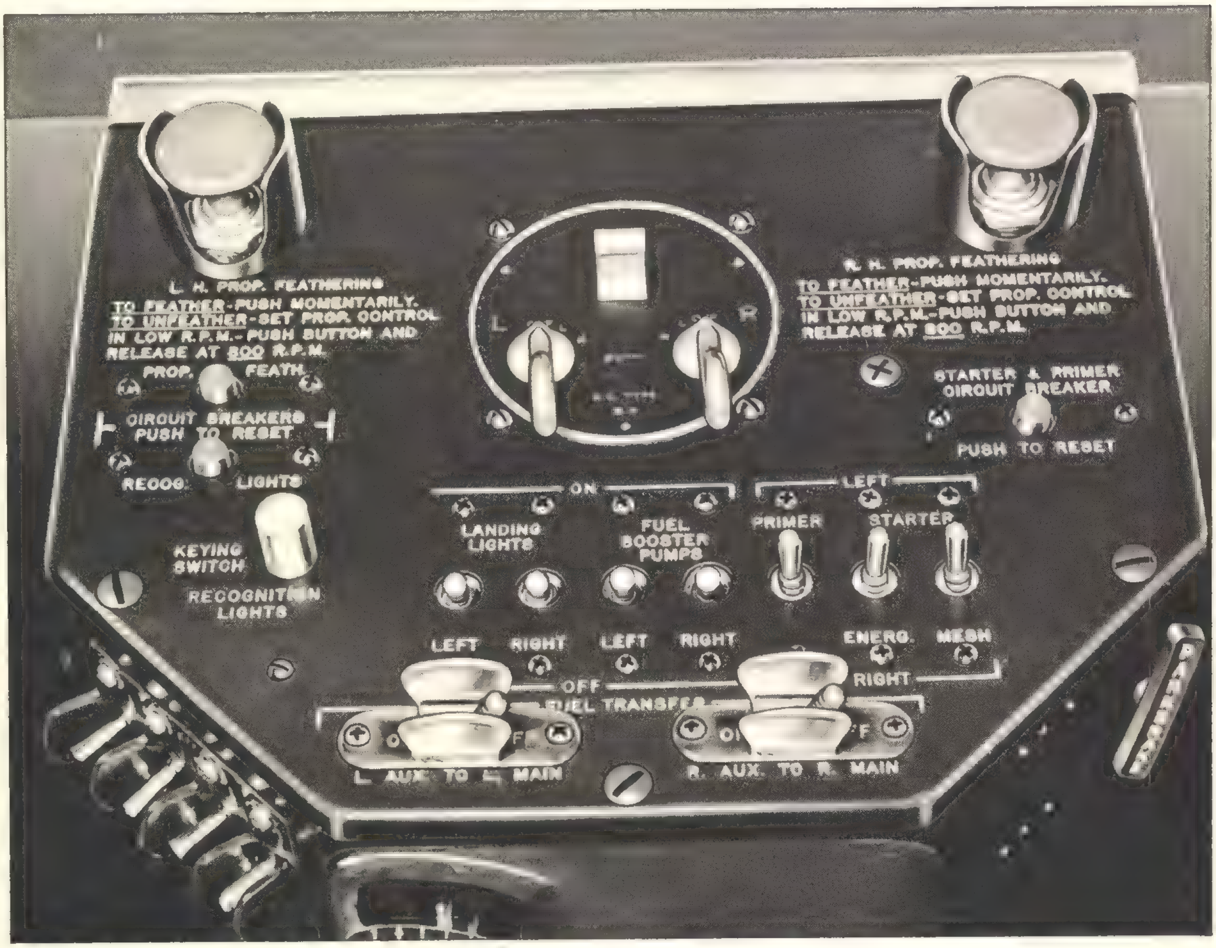


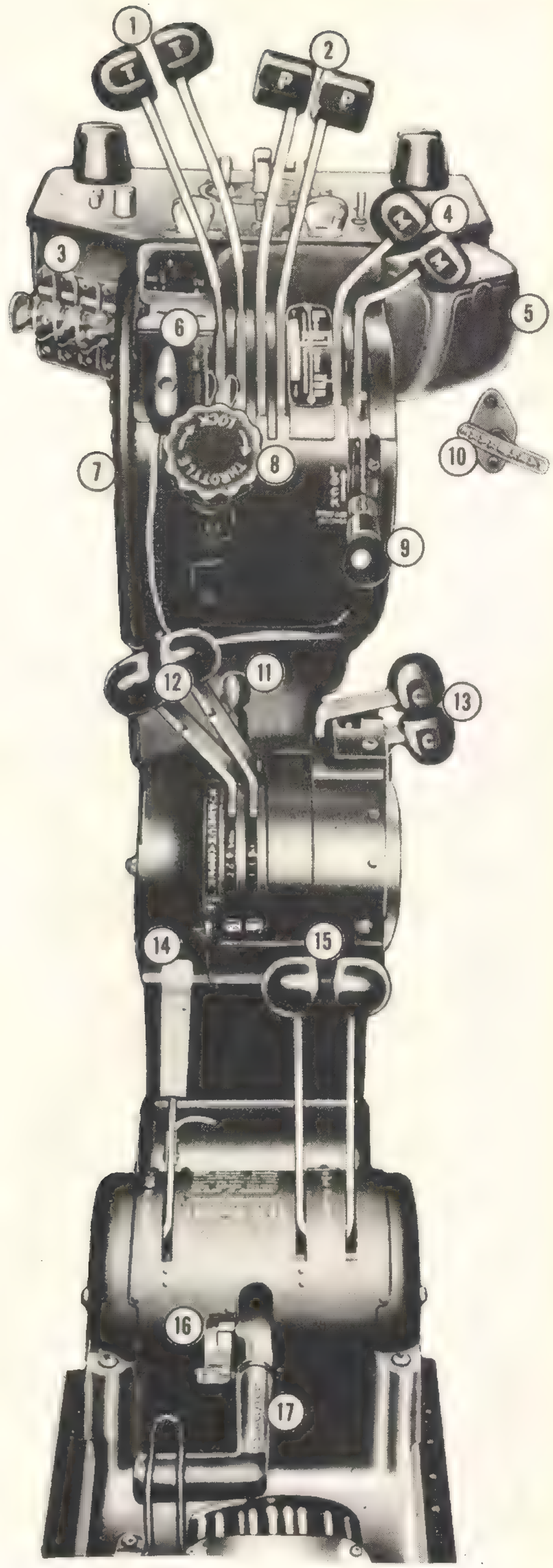
PILOT'S INSTRUMENT PANEL

1. Static Pressure Selector Valve
2. Airspeed Indicator
3. Directional Gyro
4. Flight Indicator
5. Pilot's Direction Indicator
6. Clock
7. Suction Gage
8. Remote-Reading Compass Indicator
9. Manifold Pressure Indicator
10. Oil Pressure Indicator
11. Tachometer
12. Fuel Pressure Indicator
13. Auxiliary Tanks Fuel Level Indicators
14. Landing Gear Warning Light
15. Nose Wheel Position Indicator Lights
16. Hydraulic System Pressure Gage
17. Bank-and-Turn Needle Valve
18. Altimeter
19. Bank-and-Turn Indicator
20. Rate-of-Climb Indicator
21. Bomb Release Signal Light
22. Bomb Door Indicator Light
23. Radio Compass Indicator
24. Card Holder
25. Cylinder Head Temperature Indicator
26. Oil Temperature Indicator
27. Free Air Temperature Indicator
28. Carburetor Air Temperature Indicator
29. Rear Main Tanks Fuel Level Indicator
30. Front Main Tanks Fuel Level Indicator
31. Landing Gear and Wing Flap Position Indicator
32. Blind Landing Indicator
33. Gun Sight Rheostat
34. Brake System Pressure Gage

PILOT'S SWITCH PANEL

CONTROL PEDESTAL SWITCH PANEL



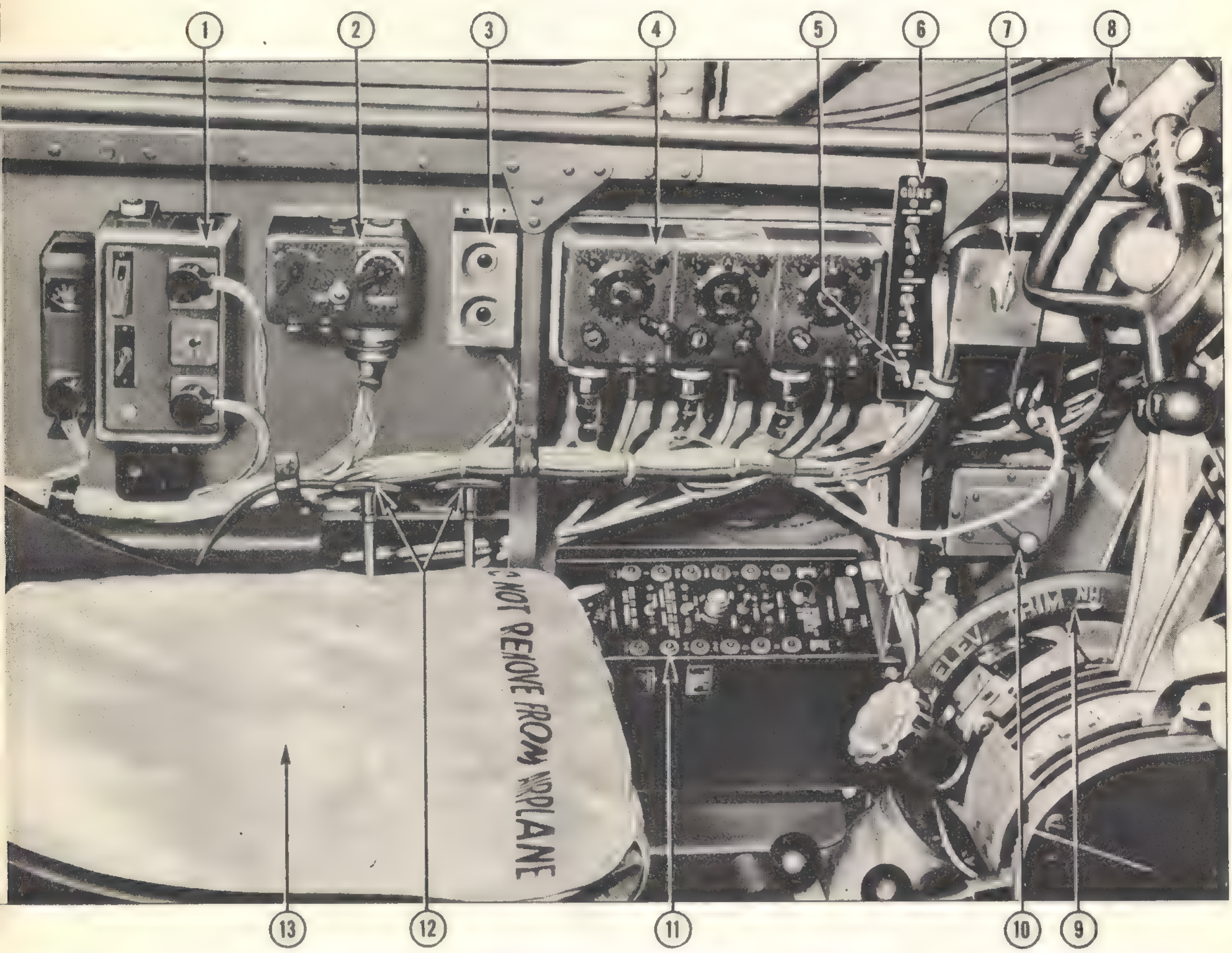


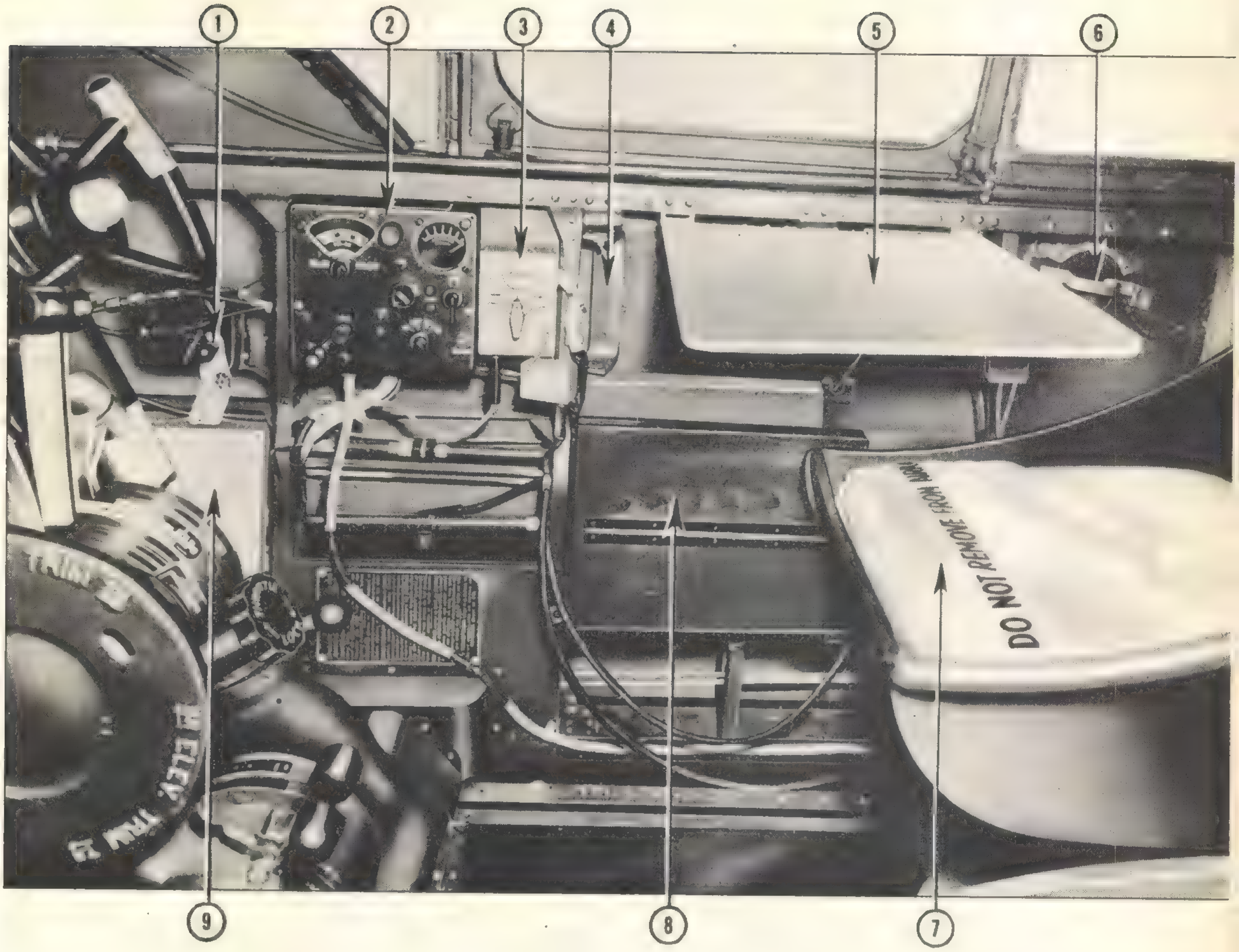
PILOT'S CONTROL PEDESTAL

1. Throttles
2. Propeller Controls
3. Recognition Light Switches
4. Mixture Controls
5. Ash Tray
6. Elevator Trim Indicator
7. Elevator Trim Control Wheel
8. Throttle Friction Lock
9. Prop and Mixture Control Friction Lock
10. Parking Brake Control
11. Supercharger Control Lock
12. Supercharger Controls
13. Carburetor Air Heat Controls
14. Wing Flap Control
15. Cowl Flap Controls
16. Landing Gear Control Lock
17. Landing Gear Control

PILOT'S COMPARTMENT—LEFT SIDE

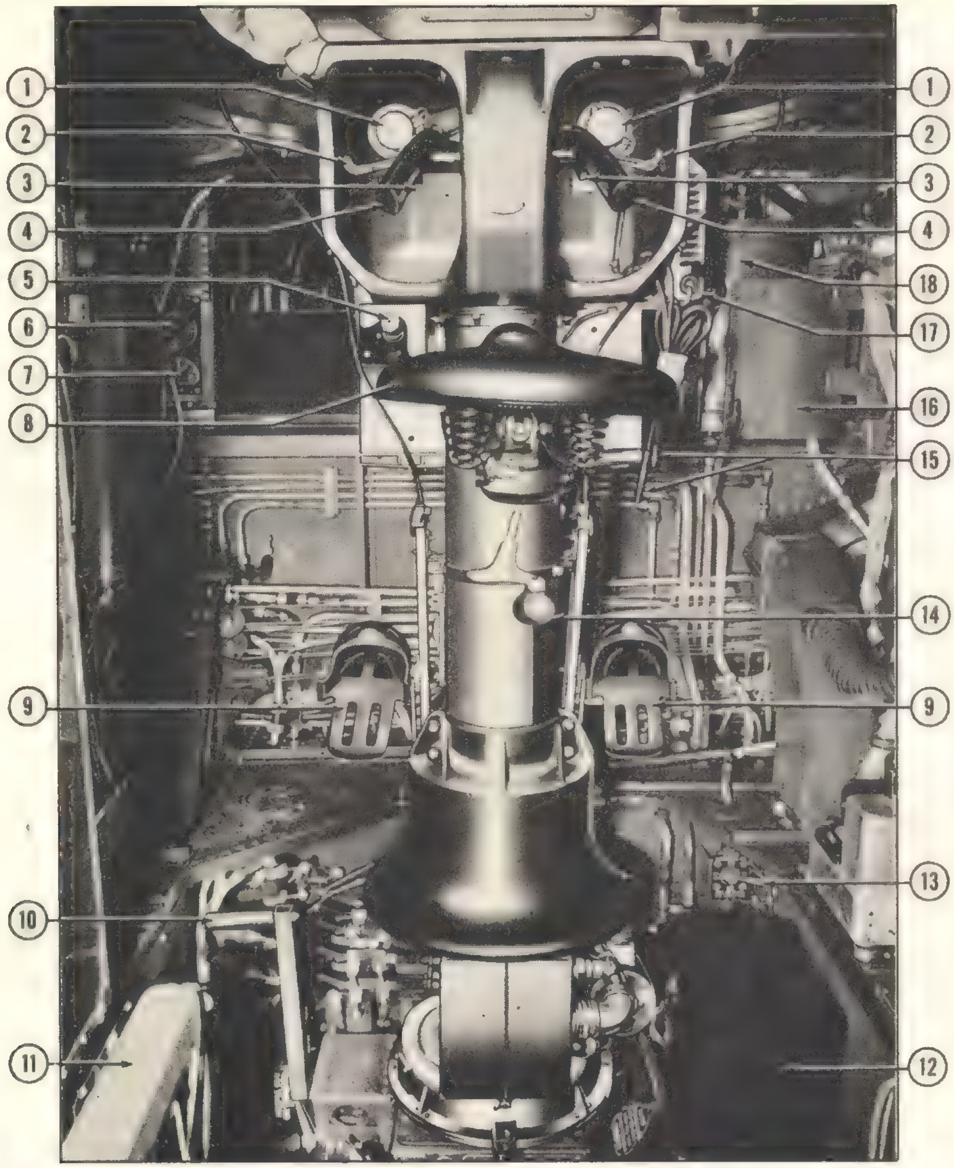
1. SCR-595 or SCR-695 Control Box
2. Command Radio Transmitter Control
3. Radio Demolition Switches
4. Command Radio Receiver Controls
5. Camera Selector Switch
6. Gun Control Switch Panel
7. Filter Switch Box
8. Sliding Window Handle
9. Elevator Trim Tab Control Wheel
10. Ventilator
11. Bomb Control Panel
12. Emergency Fuel Shut-off Valve Controls
13. Cushion





PILOT'S COMPARTMENT— RIGHT SIDE

1. Ventilator
2. Radio Compass Control Box
3. Interphone Jack Box
4. Bomb Interval Control Mount
5. Folding Table
6. Driftmeter Port
7. Cushion
8. Map Case
9. Pilot's Check List

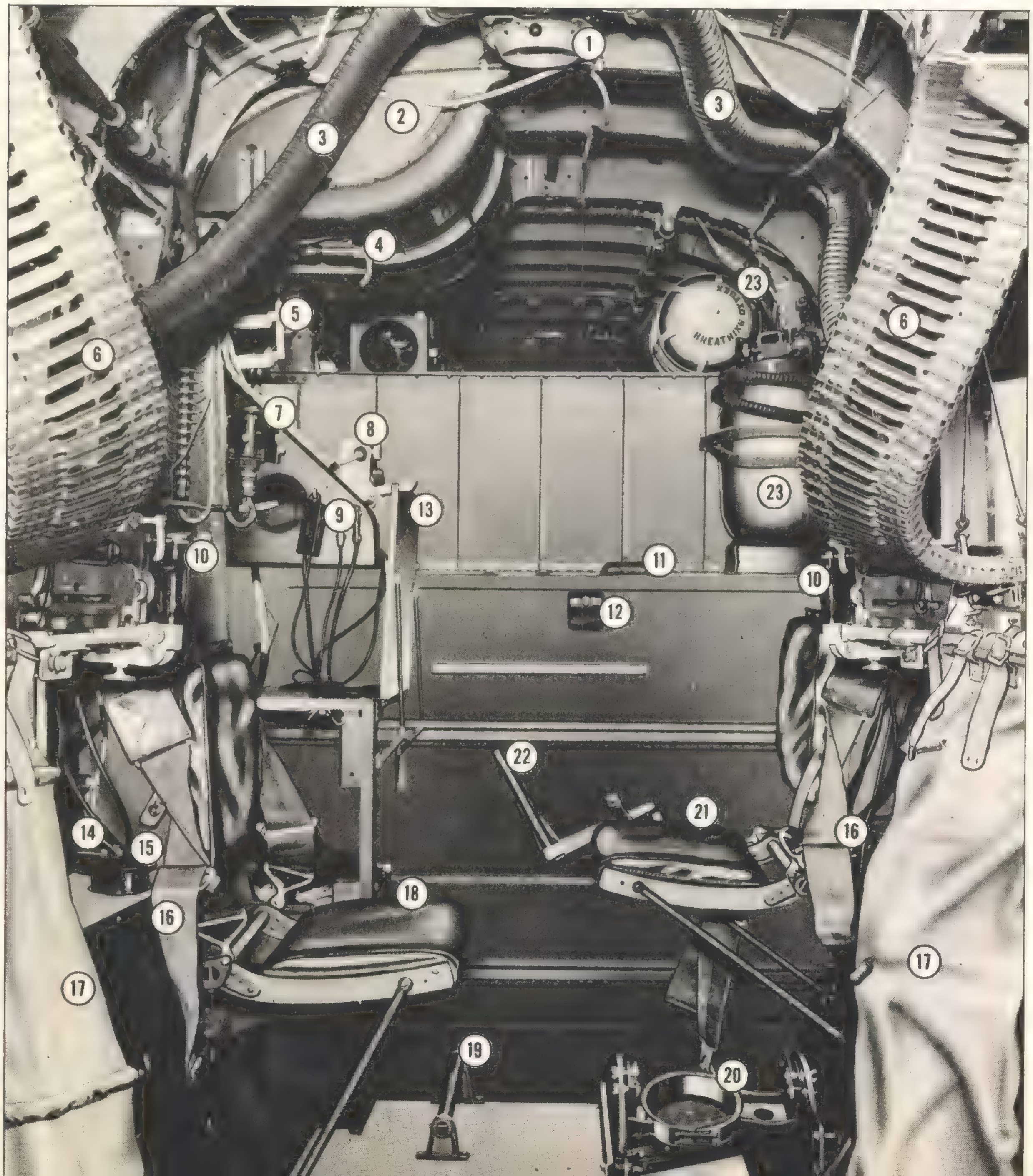


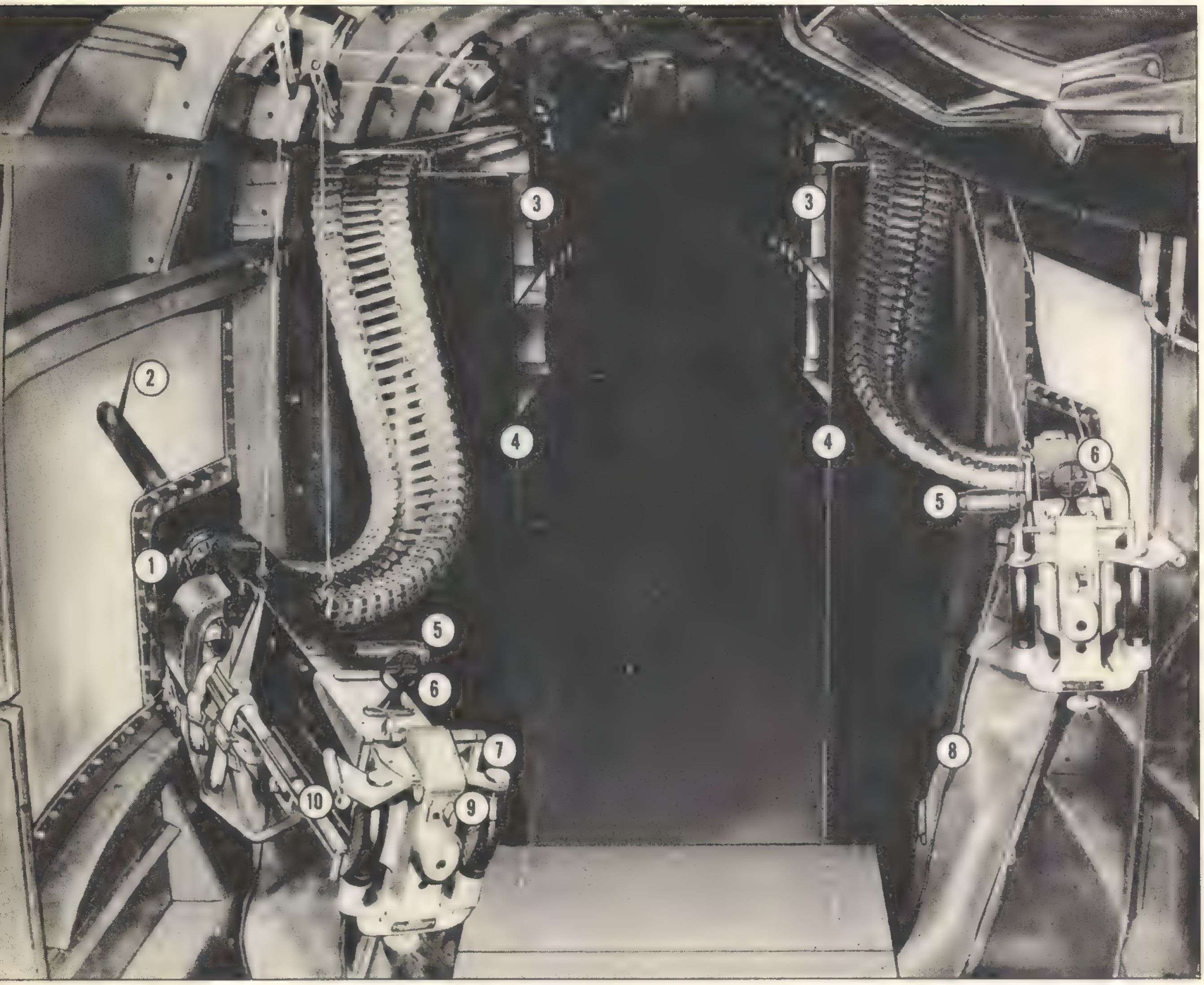
UPPER TURRET COMPARTMENT—REAR VIEW

1. Interphone Buttons
2. Safety Switches
3. Trigger Switches
4. Gun Control Handles
5. Extension Light
6. Fuel Transfer Control
7. Fuel Cross-feed Control
8. Turret Seat
9. Gun Charger Pedals
10. Emergency Fuel Pump Handle
11. Riding Seat
12. Signal Lamp Case
13. De-icer Vacuum Shut-off Valve
14. Turret Handcrank
15. Interphone Jacks
16. Armor Plate
17. Heated Clothing Rheostat
18. Hydraulic Reservoir

GUNNER'S COMPARTMENT

1. Heater Duct Control
2. Lift Raft Stowage
3. Defroster Tube
4. Lift Raft Release Handle
5. Antenna Change-over Switch
6. Flexible Ammunition Chute
7. Impact Switch
8. Interphone Jack Box
9. Interphone Jacks
10. .50-cal. Waist Gun
11. Emergency Wing Flap Crank Access
12. Ash Tray
13. Folding Table
14. Ventilator
15. Alarm Horn
16. Safety Belt
17. Case and Link Ejection Bag
18. Tail Gunner's Riding Seat
19. Footrest
20. Camera Mount
21. Waist Gunner's Riding Seat
22. Emergency Wing Flap Lowering Crank
23. Portable Oxygen Unit



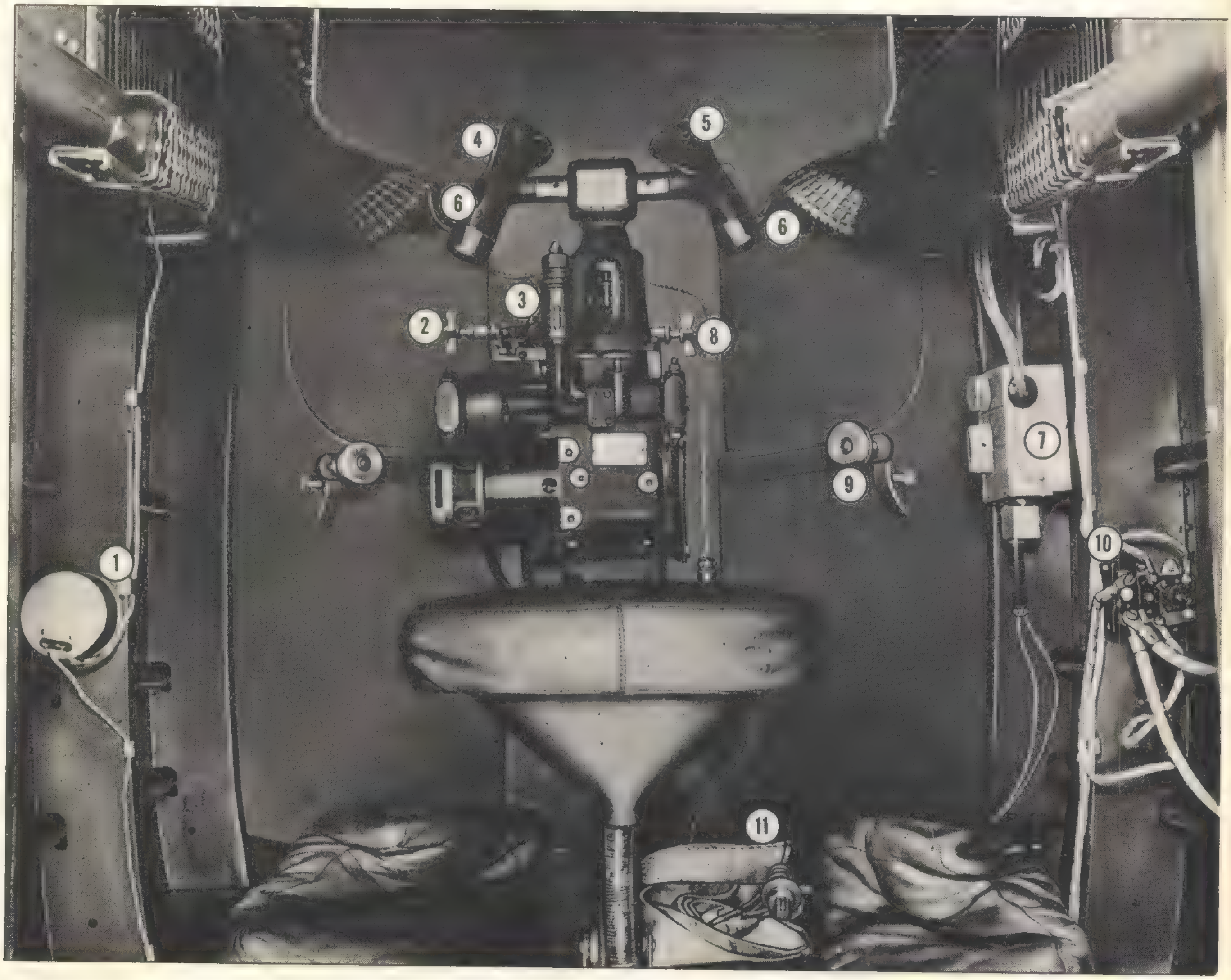


GUNNER'S COMPARTMENT—REAR VIEW

1. Gun Adapter Latch
2. Bead Sight
3. Ammunition Boxes
4. ¼" Armor Plate
5. Charging Handles
6. Ring Sight
7. Trigger
8. Case and Link Ejection Bag
9. Safety
10. Stowage Plunger

TAIL GUNNER'S COMPARTMENT

1. Gun Sight, Rheostat
2. Elevation By-Pass Valve
3. Oil Level Indicator
4. Control Grips
5. Interphone Buttons
6. Gun Safety Switch
7. Interphone Jack Box
8. Azimuth By-Pass Valve
9. Access Door Latch
10. Turret Power, Gunsight Lamp, Heated Suit, Circuit Breakers
11. Gunner's Safety Belt



POWER PLANT

The B-25 is powered by two Wright Cyclone R-2600-13 or R-2600-29, 14-cylinder, double-row radial engines. The operation of these two series is similar. Primarily aircooled, these engines have two secondary methods of cooling:

1. Scavenged engine oil is cooled by 2 oil coolers located in the outboard section of each wing before it is returned to the engines.
2. Rich fuel mixtures cool the engines at high power settings.
3. Individual flame-damping exhaust stacks reduce exhaust flame visibility at night.

GRADE 100/130 FUEL

ENGINE POWER RATINGS

RATINGS	BRAKE HP	RPM	BLOWER
Sea Level	1500	2400	Low
Takeoff	1700	2600	Low
Normal	1500	2400 at 6700 feet	Low
	1350	2400 at 13,000 feet	High
Military	1700	2600 at 5500 feet	Low
	1450	2600 at 13,500 feet	High

Supercharger

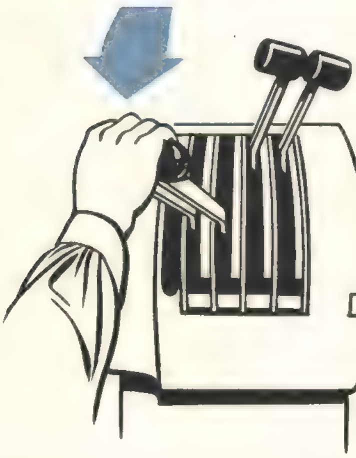
A supercharger is to an internal-combustion engine what an oxygen mask and a supply of oxygen is to a pilot.

An integral part of the R-2600 engine is the internal 2-speed, gear-driven supercharger. It supplies the necessary manifold pressures for high-altitude operation.

The impeller, acting as a power fan, is driven at a 7.06:1 ratio in low blower and 10.06:1 in high blower. This passes the fuel-air mixture from the carburetor and adapter at increased pressures to the manifold. The manifold distributes the mixture to the intake ports and the cylinder heads.

The supercharger is an integral part of your engine **at all altitudes.** Don't fall into the trap of assuming that because you are operating at medium and low altitudes, your supercharger is not important. Your supercharger must have proper care all the time, regardless of whether you intend to use high blower.

OPERATING INSTRUCTIONS



LOW BLOWER TO HIGH BLOWER

Shift From Low Blower To High Blower:

1. Mixture control "FULL RICH."
2. Reduce manifold pressure. (Reduce throttles sufficiently to prevent the surge in manifold pressure exceeding the prescribed power setting when the shift is made.)
3. Set rpm at 1700.
4. Shift the controls rapidly and evenly from "LOW" to "HIGH," and lock. Make this a quick, positive action.
5. Re-set the desired power setting.

Shift From High Blower To Low Blower:

1. Mixture control "FULL RICH."
2. Reduce throttles. (Your manifold pressure must not exceed the setting for 1700 rpm.)
3. Set rpm at 1700.
4. Shift the controls from "HIGH" to "LOW" in a quick, positive action.
5. Re-set the desired power setting.

Note: For maximum performance above 12,000 ft. reduce rpm to 2400. This adds 5 to 8 mph. to the maximum speed.

HIGH BLOWER TO LOW BLOWER

Flight Instructions

1. Except where airfields are at extremely high altitudes, always take off in "LOW" blower. (There are no fields in the continental U.S. where "HIGH" blower take-offs are necessary.) While in "LOW" blower, operate the engine as a single-speed supercharged engine.

2. Never operate in "HIGH" blower below 9,000 feet. The power gained by operating in "HIGH" blower below this altitude is offset by the power required to operate in "HIGH" blower. Make the shift from "LOW" to "HIGH" blower between 11,000 and 13,000 feet, depending on the need for additional power.

Warning

Never use AUTO-LEAN mixtures above 10,000 ft. when the supercharger is in HIGH blower. Under these conditions the carburetor delivers too lean a mixture. This results in undesirably high engine temperatures.

Never operate in "HIGH" blower below 1500 rpm. During prolonged operation in "HIGH" blower, change to "LOW" blower for 15 minutes every 2 hours. (This removes sludge from the clutch.)

GROUND DE-SLUDGING

De-sludge the supercharger before you stop the engines after the final flight each day. You can start de-sludging as you taxi in to the line.

To De-sludge the Supercharger:

1. Set the engines at 800-1000 rpm.
2. Shift from LOW to HIGH blower every 30 seconds.
3. Continue this for 5 minutes if possible.
4. Shift to LOW blower before stopping the engines.

At this engine speed the supercharger clutch does not shift from LOW to HIGH blower but remains in neutral. This allows a large quantity of oil to flow through the supercharger clutch, washing out any accumulation of sludge collected during flight.

ACCESSORY SECTION

The accessory section, on the rear of the engine, contains various devices for supplying pressures and operational action to the airplane. These are:

Right and left scintilla magnetos
Generator
Inertia starter
Fuel pump
Oil pump
Scavenger pump
Hydraulic pump
Vacuum pump
Cuno automatic filter
Tachometer drive gear

A number of instrument fittings complete this section.

CARBURETORS

Holley variable-venturi carburetors (Model 1685-HA or HB) operating at pressures of 6-7 lb. sq. in. supply the engines with fuel.

The carburetors are the pressure-metering type. By operating the throttles, you control the amount of air passing the venturi throats; the air, by its varying pressures, measures the amount of fuel allowed to enter the adapter section and mix with the air. This establishes a predetermined fuel-air ratio.

These carburetors incorporate several devices to increase and decrease the fuel-air ratio in relation to the engine power output.

1. A variable-venturi replaces the conventional venturi-with-butterfly-valve to minimize carburetor icing.

2. A power mixture valve automatically changes the mixture to FULL RICH if you attempt full-power operation with the manual mixture control in CRUISING LEAN.

3. A stabilizer valve makes fine corrections in mixture to compensate for changes in temperature and atmospheric pressure.

4. A vacuum operated acceleration pump works automatically. It is not linked to the throttle; thus with the engine off you cannot prime or flood it by opening and closing the throttles.

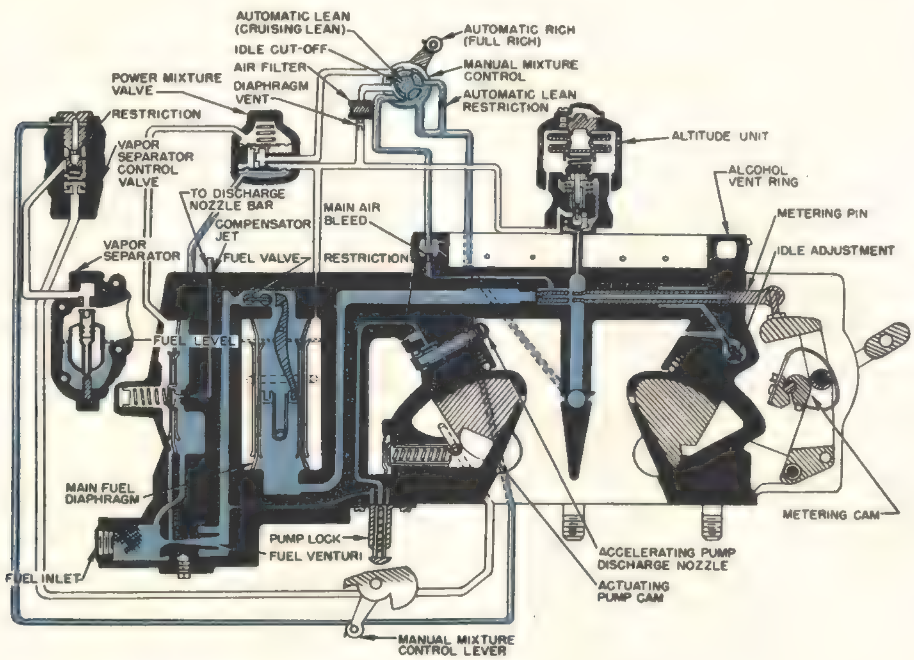
5. A power compensator unit automatically enriches the mixture beyond FULL RICH when the engine delivers 70% of full power. As the percentage of power delivered increases, the mixture is enriched proportionately.

6. A primer, electrically operated, bypasses fuel from the main fuel line to a three-point priming system. Two outlets open into the carburetor adapter, the third into the supercharger section. The outlets into the adapter are used for normal operation. The third, in the supercharger section, is safetied OPEN for cold weather operation and CLOSED for normal operation.

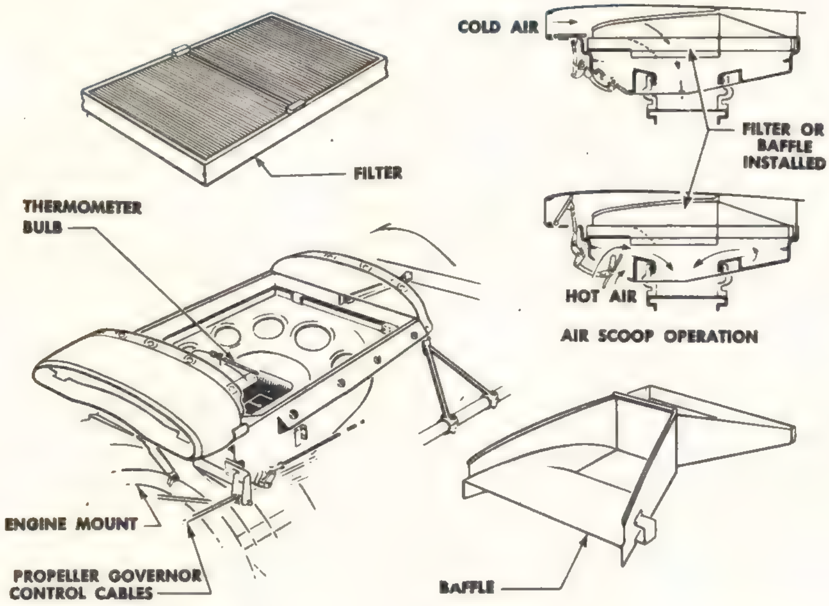
Priming

Priming is necessary to supply a fuel/air mixture to the cylinder heads rich enough to start a cold engine. The priming switch is a three-position spring loaded toggle switch located on the pilot's pedestal.

Prime each engine 2 seconds while energizing the starters.



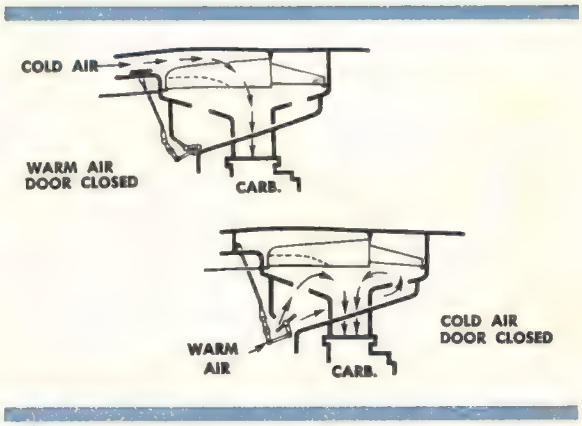
AIR INDUCTION SYSTEM



Air enters the induction system through air scoops above the nacelle. The ram action of the air mass supplies the energy to move cold air through the system.

A carburetor heat control provides an alternate source of air, allowing heated air to flow from around the cylinder heads to the system.

Normally there is a baffle in the air-mixing chamber. Air entering horizontally through the cold-air intake is deflected down into the carburetor inlet. Under dusty atmospheric conditions an air filter in the air-mixing chamber replaces the baffle.



Carburetor Air Filter

The false impression exists among some pilots and mechanics that the carburetor air filter affects airplane performance. Installation of a filter is merely equivalent to closing the throttles slightly. This means that for all altitudes less than critical, where manifold pressure limits prevent full throttle opening, the filter has no effect at all on engine power output or airplane performance.

Manifold pressure gives the best indication of engine power output, and at a given pressure the engine develops the same power regardless of whether a filter is installed. The only time that removal of the filter benefits performance is when the throttle is full open and still more manifold pressure is permissible.

When the filter is installed, it affects only cold ram air. Heated air does not pass through the filter element.

CARBURETOR AIR HEAT

LATE AIRPLANES

Special exhaust stacks are installed on cylinders No. 3 and 13 on late airplanes. Hydraulically operated hot air doors in the cowling behind the stacks are linked to a gate in the air scoop casting. Thus, as the hot air doors open and allow an increase in the flow of warm exhaust air, the gate in the air scoop decreases the flow of cold air. This system provides a 50°C (90°F) temperature rise to prevent icing.

Poppet valves in the baffle plate permit air to flow to the carburetor from the engine accessory section if the hot air doors fail to function properly.

To Operate

1. Use the same operating technique used on the old system.

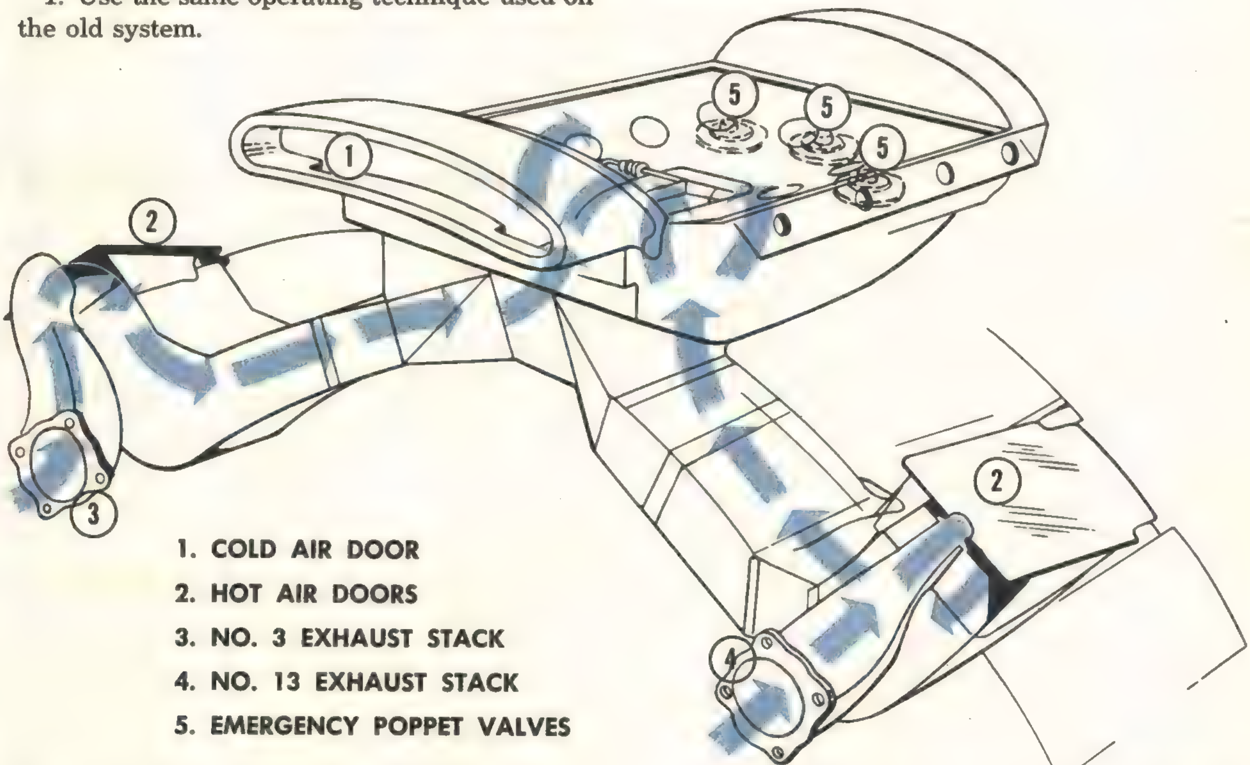
2. **Return the control handle to neutral when the desired temperature rise occurs.**

Warning

This system is hydraulically operated. The doors continue to the **full open position** if the control is not returned to neutral.

Don't set the carburetor heat rise system with the engines idling. The amount of exhaust gases delivered to the carburetor varies with the engine speed.

Note: When the carburetor heat rise system is used frequently the carburetors must be inspected regularly and any excess carbon deposits removed.



1. COLD AIR DOOR
2. HOT AIR DOORS
3. NO. 3 EXHAUST STACK
4. NO. 13 EXHAUST STACK
5. EMERGENCY POPPET VALVES

EARLY AIRPLANES

The carburetor air heater on the B-25 is a 2-position gate in the air induction system.

Manual controls directly connect this gate to the position handles in the pilot's cockpit. It cannot be set in an intermediate position and it is spring loaded to return to "NORMAL" if the controls are shot away.

Keep controls at "NORMAL" setting unless carburetor icing conditions are suspected, as a loss of horsepower results with the controls in "ICING." This effect increases as power is increased.

Whenever you observe a gradual loss of manifold pressure without a change in throttles or attitude, or the engine runs rough without apparent cause, move the control to "ICING."

In this position the air scoop entrance is closed off, and ice free and heated air enters the carburetor from behind the cylinders.

Operation in "ICING" will not harm the engines. Even in warm weather the carburetor air temperature rise is small. The engines lose efficiency, however, since fuel vaporization is impeded.

Takeoffs are made with the controls at "NORMAL" to obtain maximum power and prevent detonation at high power settings.

Resistance-type carburetor air thermometers are installed in the intake air stream on each carburetor. They are electrically connected to a dual indicator on the right side of the instrument panel.

Keep the air inlet temperature above 15°C when you suspect carburetor ice.

A temperature between 15°C and 30°C is desirable. If, with the carburetor air control at "ICING," a temperature of 15°C cannot be maintained, move the control to "NORMAL" to provide air to the carburetor at so low a temperature that icing will not occur. If, with the carburetor air control at "ICING," ice that is already formed is not eliminated, use the alcohol anti-icing system (if installed).

FUEL SYSTEM

Each engine has an independent fuel supply, interconnected by fuel transfer and fuel cross-feed systems. The fuel lines and cells are self-sealing.

The main fuel supply is carried in 4 large fuel cells, 2 in each wing center section between the fuselage and the nacelle. The front cell in each wing has a capacity of 184 gallons, the rear cell 151 gallons.

To reduce the fuel system's vulnerability to enemy fire, the engine is supplied only from the main cells. A flutter valve in the adapter between the front and rear cells allows fuel to flow from rear to front but restricts a reverse flow. Thus, if the rear cell is damaged you lose the fuel in the rear cell, but you don't lose the remaining fuel supply in other cells.

An electric fuel booster pump mounted below the adapter serves 3 important functions:

1. Furnishes adequate pressure for engine starting.

2. Provides emergency fuel pressure for operation below 1000 feet.

3. Provides additional fuel pressure above 10,000 feet to prevent vapor lock.

All fuel flow, whether for transfer or normal operation, is from rear to front. The main cells supply fuel to the engines through the adapter and the booster pump. Fuel leaving the booster pump flows to the cut-off valves, thence to the fuel strainers and the fuel pump. The pump boosts pressure to 6-7 lb. sq. in. before the fuel enters the carburetor.

There are three interconnected fuel cells with a common filler cap outboard of the nacelle in each wing. The total capacity of this auxiliary fuel supply in each wing is 152 gallons. Because all 3 cells are filled, measured, and distribute their fuel through common lines, they are considered as a single tank.

This fuel is transferred to the front main tank in each wing by an electric transfer pump, controlled by a switch on the pilot's pedestal.

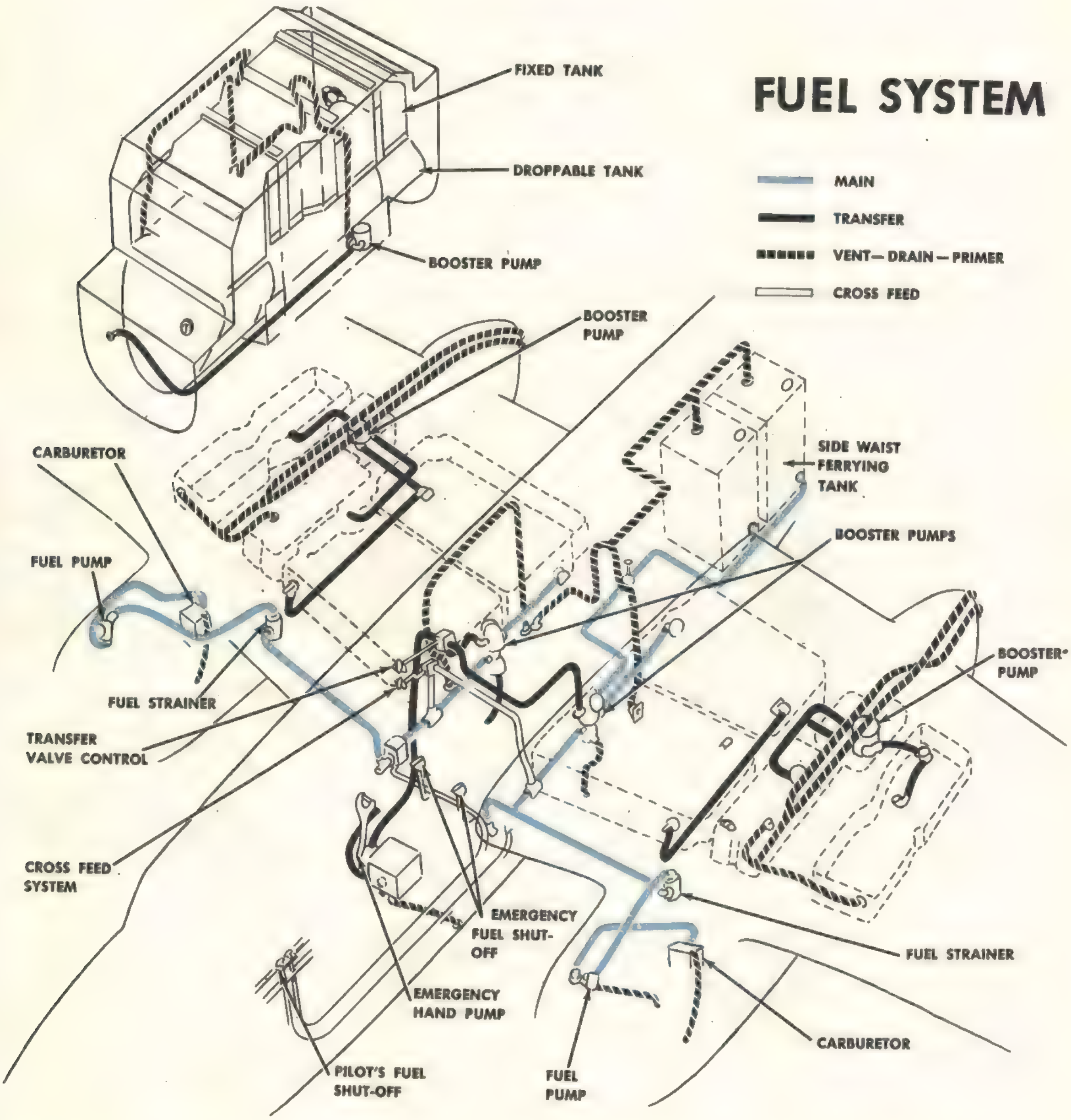
Additional fuel for long-range and ferry missions may be carried by the installation of a fuselage fuel cell. A 215-gallon self-sealing fuel cell is strapped into the top of the bomb bay and becomes an integral part of the airplane. You can carry only partial bomb loads when this cell is installed.

If no bombs are to be carried, a 335-gallon metal tank may be suspended from the bomb shackles and salvoed in an emergency.

Transfer fuel from the fuselage tanks to the front main cell by an electric pump and in emergencies by a double-action hand pump.

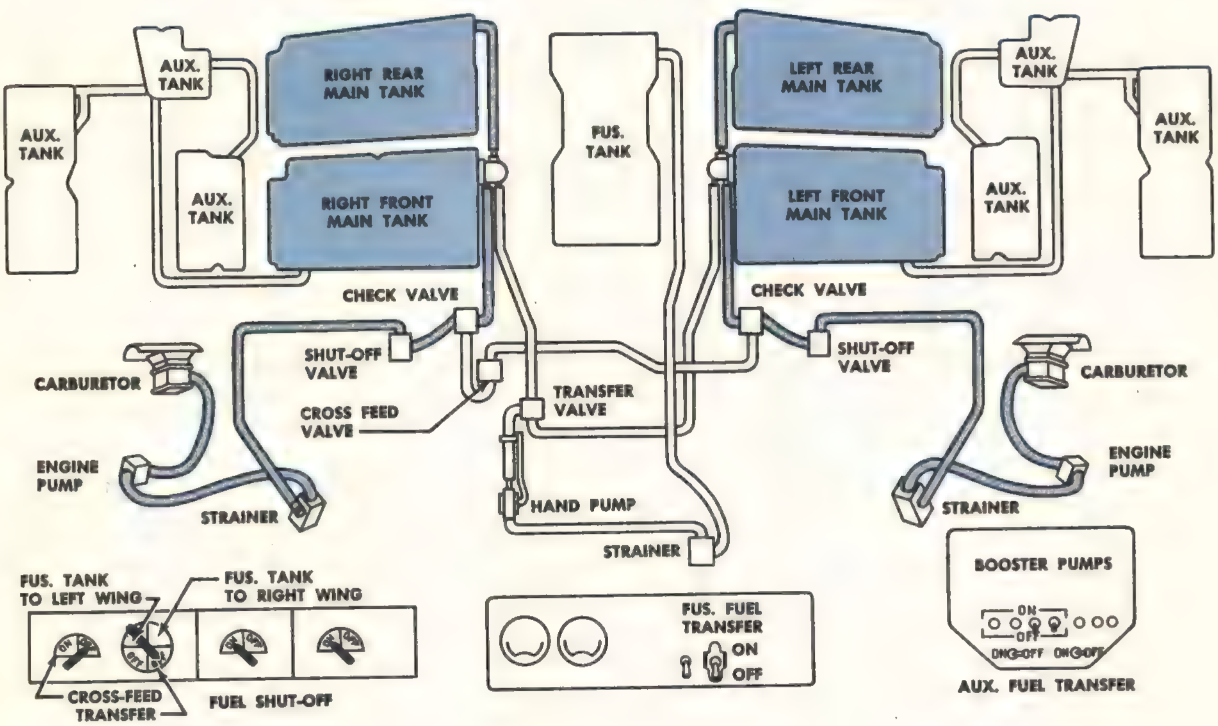
Fuel transfer valves for the fuselage tanks are on the forward wall of the bomb bay.

Use the crossfeed system for emergency operation only. By using the crossfeed, you can supply fuel from one or both tanks to one or both engines.

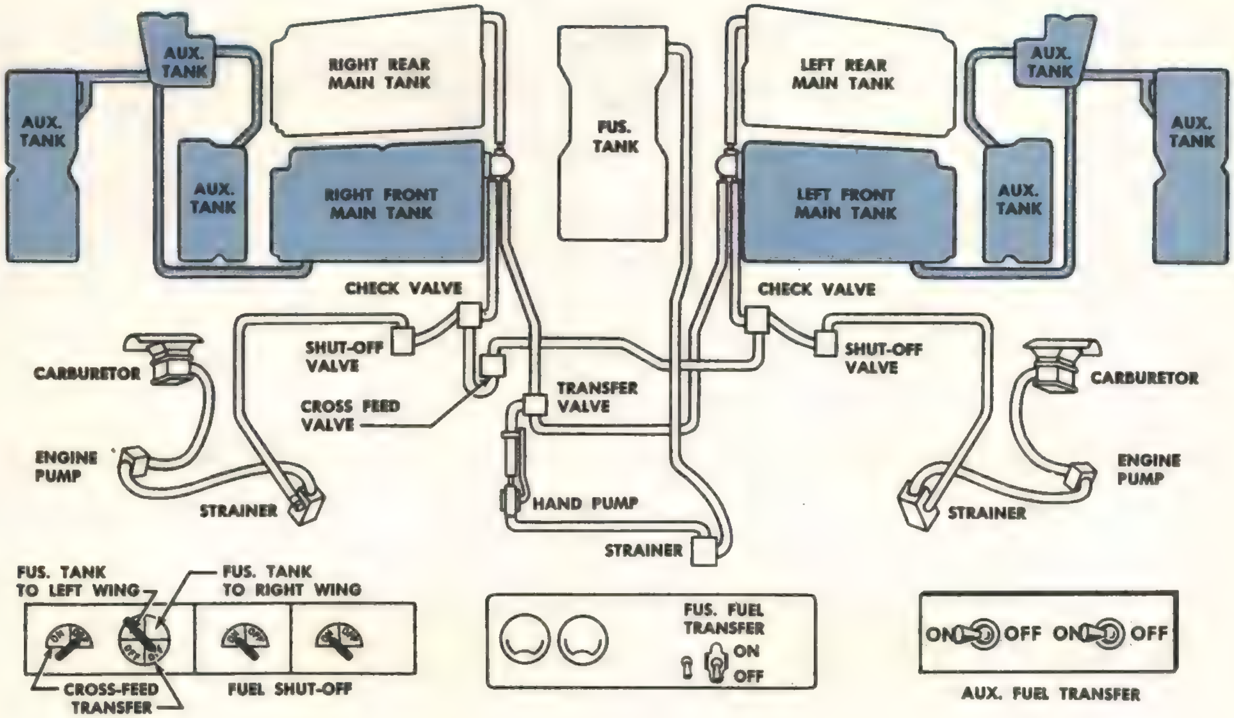


Fuel System Operation

Every man on your crew must know the fuel system so thoroughly that a mistake in its operation is impossible.



NORMAL OPERATION



AUXILIARY FUEL TRANSFER

To use auxiliary fuel you must first get it into the front main cells.

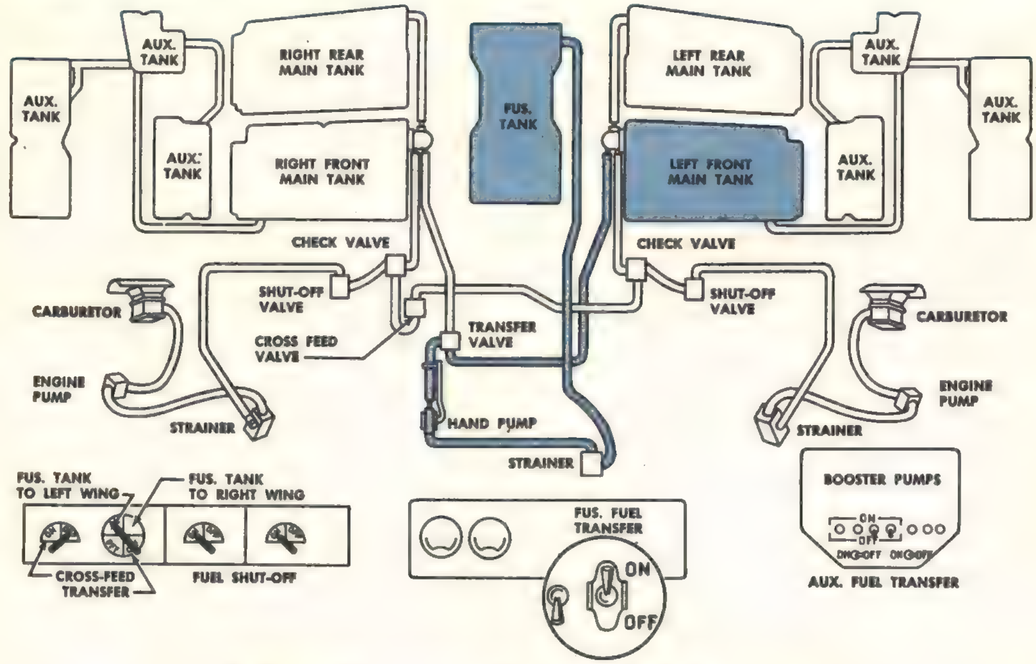
To transfer fuel from the auxiliary wing cells;

1. Check fuel levels in front cells to see that space is available for transfer.
2. Turn auxiliary fuel transfer switches "ON." (On pilot's pedestal.)
3. Turn liquidometer to the front cell receiving fuel.
4. After front cell is full turn transfer switch "OFF."
5. Repeat on opposite side.

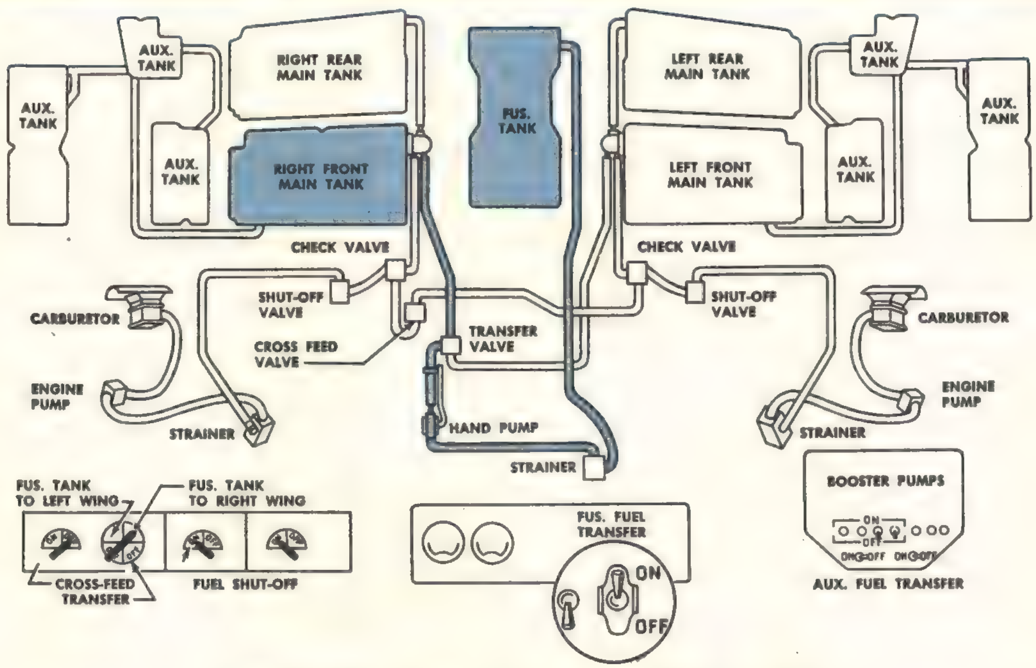
There are no valves to open and close during this transfer. When transferring fuel, time the operation to give equal distribution to right and left cells.

Warning

Don't leave switches "ON" after front cell is full. Fuel may be pumped overboard through a loose filler cap.



FUSELAGE TANK TO LEFT FRONT MAIN



FUSELAGE TANK TO RIGHT FRONT MAIN

Fuselage Tank Fuel

Before you can use fuel from any fuselage tank you must transfer it to either the right or left front main fuel cells.

Transfer fuel as follows:

1. Turn fuel transfer valve from "OFF" to either "FUS. TANK TO LEFT WING" or "FUS. TANK TO RIGHT WING."
2. Turn transfer pump switch "ON." (On generator control panel.)
3. Turn liquidometer to front cell receiving fuel.
4. When transfer operations are finished turn transfer switch "OFF" and place fuel transfer valve at "OFF."

Note

Keep the main fuel cells as nearly full as possible. Transfer fuel at frequent intervals. It may become necessary to salvo the bomb bay tank. In that case you will want as much fuel as possible in the front main cells.

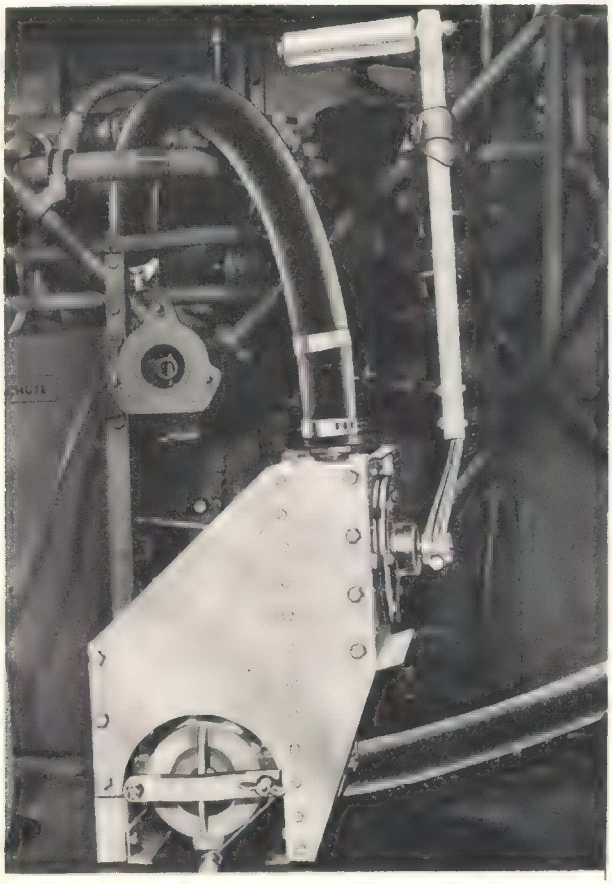
Emergency Fuel Transfer

If fuselage transfer pump fails:

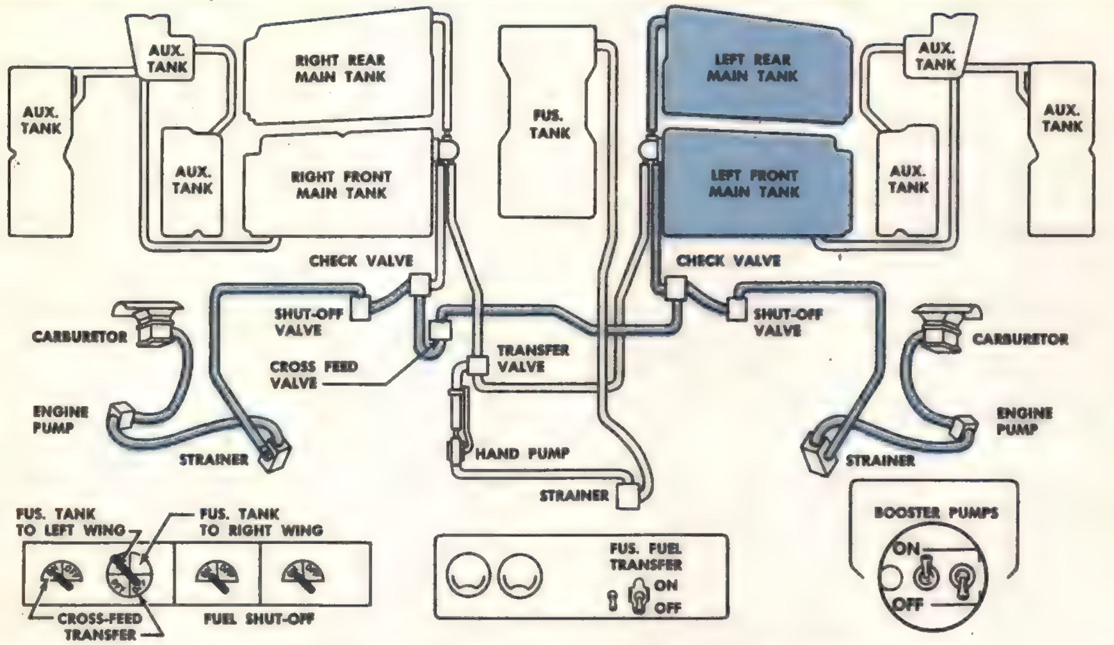
1. Set transfer valve to desired position.
2. Unstrap hand transfer pump handle.
3. Operate pump until desired fuel transfer is complete.
4. Return handle to stowed position and turn transfer valve "OFF."

Crossfeed Operation

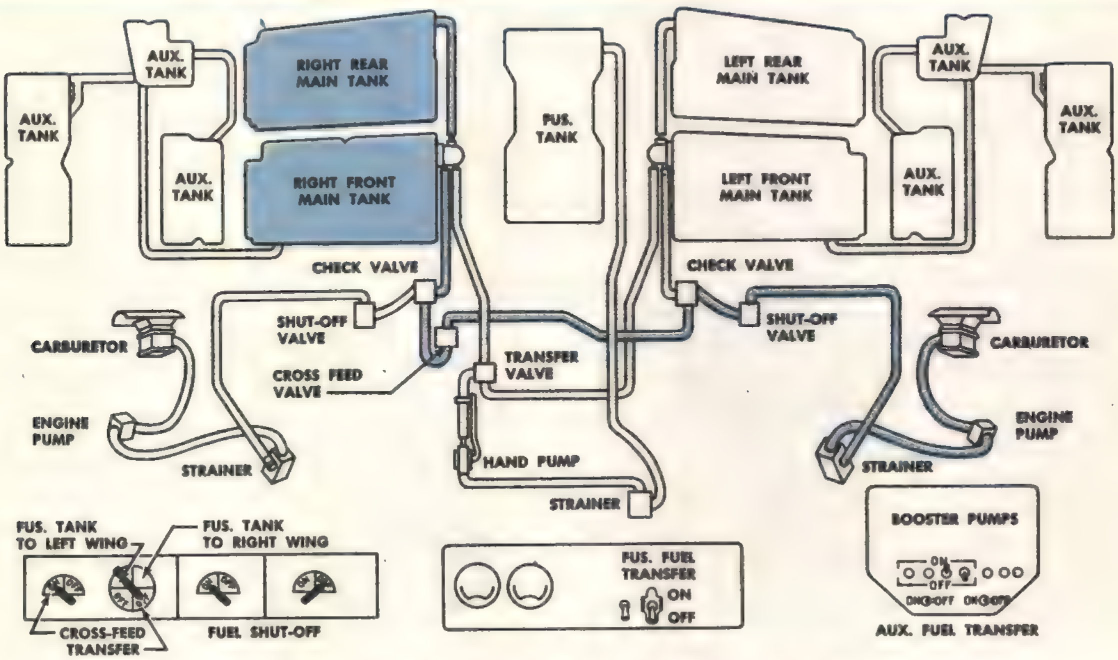
The fuel crossfeed is installed for emergency use only. Keep the crossfeed valve "OFF" unless an engine-driven fuel pump fails. The crossfeed system allows you to operate either or both engines from either or both tanks.



EMERGENCY FUEL TRANSFER HAND PUMP



FUEL TANKS ON ONE SIDE TO BOTH ENGINES



FUEL TANKS ON ONE SIDE TO OPPOSITE ENGINE

OIL SYSTEM

Each engine has an independent oil supply. The self-sealing oil tank mounted behind the firewall on each nacelle has a capacity of 34 gallons. It contains a hopper tank to accelerate oil warming and facilitate oil dilution. A sump and standpipe in the lower part of the tank insure a supply of 1½ gallons of oil for the propeller feathering system even if the main oil system is dry.

On early models not equipped with self-sealing tanks, the tank is of the same outward size but will hold 37½ gallons of oil.

The Y drain for each oil system is in the lowermost part of the system. This unit contains a bulb which is connected to the oil temperature gage, and also an inlet leading from the oil dilution valve to insure gasoline reaching every part of the oil system.

Check this drain frequently for leaks. A leak will cause the loss of the entire oil supply.

The oil pump is a gear-type, positive displacement pump incorporating 3 pumps in one housing: a pressure pump and 2 return or scavenger pumps—one for the forward and one for the rear sump of the engine.

A spring-loaded valve adjusts the pressure pump, bypassing the oil side to the inlet side. Turning the adjustment clockwise increases the pressure.

The oil pressure system is relieved by a spring-loaded check valve in the line between the oil pump and the oil cuno. It is set to open at a pressure of 90 lb. sq. in. Pressure greater than 90 lb. forces this valve off its seat and allows oil to bypass and return to the main tank. This keeps the pressure constant within a + or —1 lb.

The cuno strainer is made up of many metal discs, with a small metal plate between each pair of discs. It strains out foreign particles. A small flange operated by oil pressure turns the discs, making the cuno self-cleaning.

The cuno incorporates an automatic bypass valve. This valve opens and allows the oil to flow around the strainers if the plates become badly clogged.

The oil temperature regulators are outboard of the engine nacelle in each wing, with 2 regulators connected in parallel for each system.

Each regulator consists of a 10-inch-diameter oil cooler controlled by a thermostatic valve. Each cooler comprises a cooling element, serving as a core, enclosed by a shell and surrounded by a warming jacket. It is similar to the radiator of an automobile.

The oil has 2 paths of flow. One is through the warming jacket past a relief valve and out, thus bypassing the cooling element. The other path is around the warming jacket to the cooling element inlet, through the cooling element and out.

The position of the thermostatic valve determines the path to be used. Regulation of the oil temperature is fully automatic once the valve is calibrated.

Air for cooling enters the leading edge of the wing. The amount of cooling effected is in proportion to the mass of air flowing through the air ducts. On early series the amount of air flow can be manually controlled from the cockpit by direct linkage with the oil cooler shutters. On series H and J, the operation of the oil coolers is automatic.

Use the oil shutters to control the temperature of the engine oil. Open and close them as necessary to keep the oil temperature within operating limits.

Cold, gummy oil may clog the cooler elements during extremely cold weather. This will show up as an abnormal rise in oil temperature. To correct this:

1. Close the oil cooler shutters for a maximum of 2 minutes.

2. Open the shutters and check for a drop in oil temperatures.

This procedure builds up an extremely high oil temperature and cleans the coolers of oil and gum. Resume normal operation as the temperatures drop to normal limits. On series H and J, a surge valve allows the oil to bypass the cooling element entirely. The oil pressure

gage in older planes is an autosyn-type instrument on one of the engine mounts. In the newer planes it is a pressure transmitter.

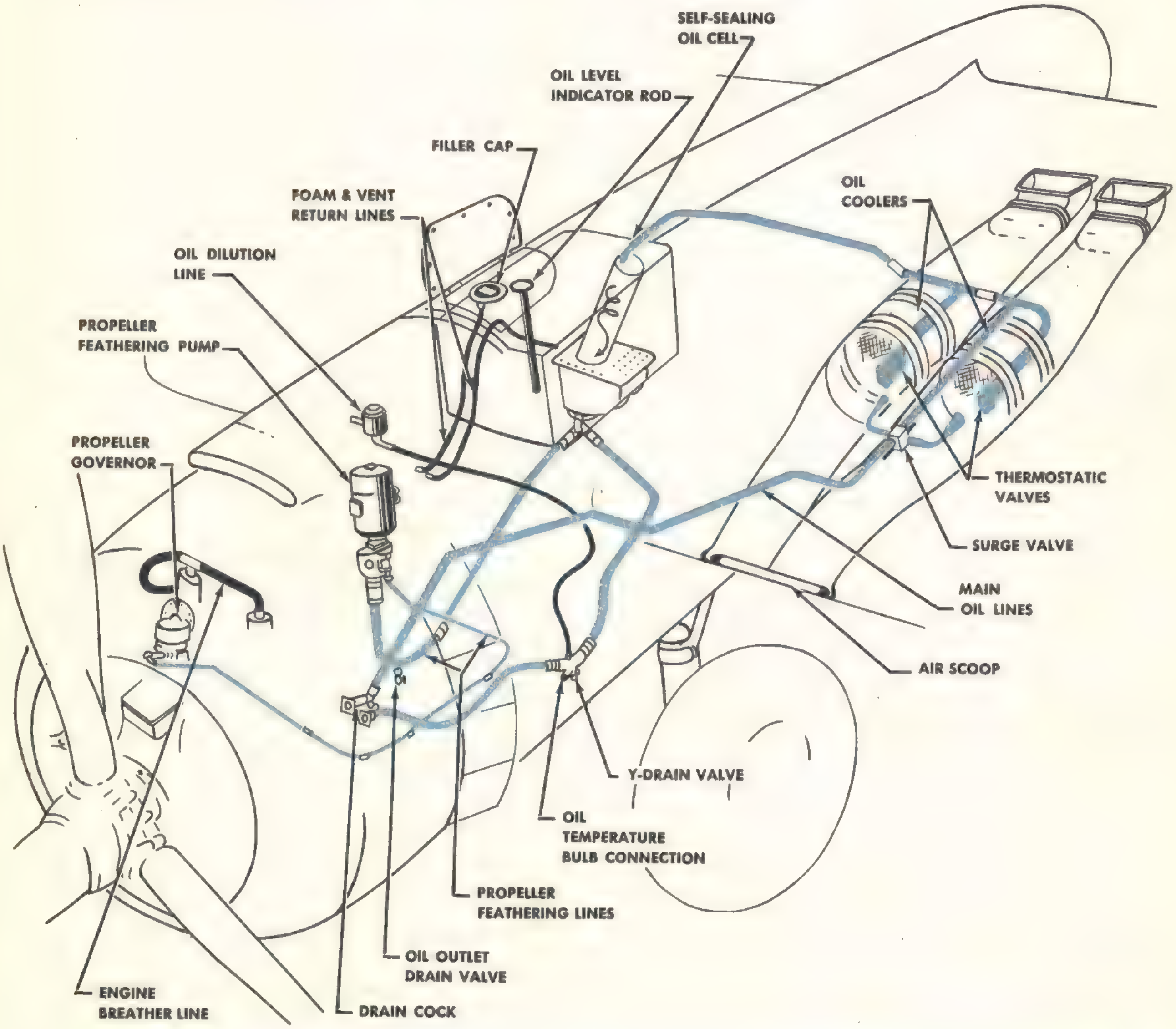
The pressure transmitter is described in the section dealing with instruments.

The temperature bulb in the Y drain is connected directly to a bourdon-tube gage on the instrument panel calibrated to read temperature directly.

The drain plug in the front sump of the engine is magnetic, to aid in clearing steel particles from the oil. It is also an aid in indicating internal damage in the engine.

The maximum oil consumption of the engine at cruising throttle setting is 16 quarts per hour; at takeoff throttle setting it is 28.2 quarts per hour.

The airplane should have full oil cells (34 gallons each) for takeoff. However, in an emergency it may be flown with a minimum of 21 gallons in each cell.



DUAL IGNITION SYSTEM

The ignition system, except for the induction vibrator coil, is independent of all other electrical power sources.

There are 2 magnetos on each engine. The right magneto furnishes spark to the front plugs and the left to the rear plugs in both banks of cylinders.

Dual ignition provides more efficient combustion, decreasing the possibility of detonation. It also acts as a safety factor by providing 2 separate ignition systems on each engine.

Since the magnetos do not furnish sufficient spark until they are turning 75 to 85 rpm, it is necessary to provide starting spark from an induction vibrator coil. It is in the power panel junction box and steps up 24-volt current to 20,000-25,000 volts at a low amperage output. To operate it, engage the starter with the meshing switch. High-voltage spark is sent to the right magneto, firing the front plugs as they are less likely to foul. The induction coil continues to operate until the meshing switch is released.

Caution

Never keep the induction vibrator coil in continuous operation, as tremendous heat is generated, and the coil will burn out.

Necessary lines, fuses, and switches complete the ignition system.

ELECTRICAL SYSTEM

The electrical power which operates and controls the various units of the B-25 is supplied by 2 generators, supplemented by 2 storage batteries connected in parallel.

The batteries, behind the firewall in each nacelle, furnish 24-volt current to the electrical equipment when the generators are not operating.

Battery-disconnect solenoids connect the batteries to the electrical system. (On late series aircraft B-4 relays replace these solenoids.) The solenoids are in the power panel junction box and are controlled by switches on the pilot's switch panel. Both are "ON" for normal operation.

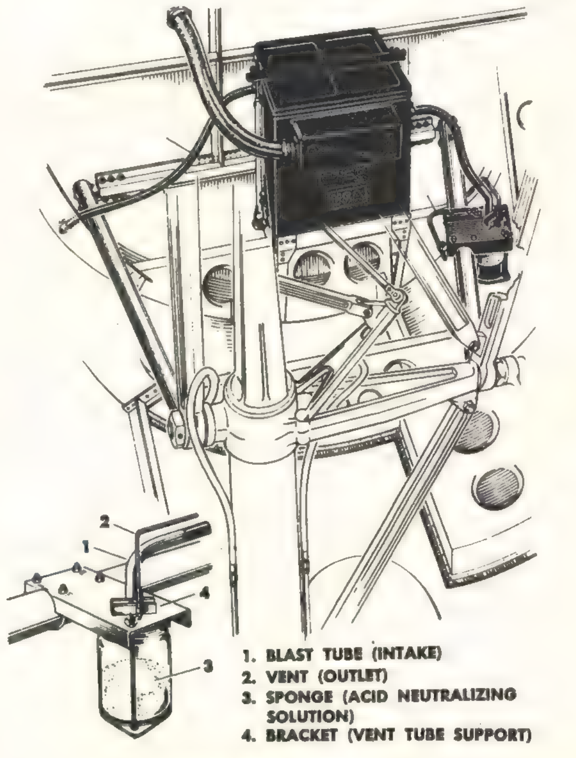
There is an outlet in the right nacelle for the use of external power. (All electrical switches must be "OFF" before applying external power.)

There is a 30-volt, 200-ampere, blast-cooled generator on the accessory section below the starter of each engine. They are geared to the engine drive shafts at a 1.38:1 ratio.

The generators recharge the batteries and furnish all necessary electrical power. The voltage output of the generators is kept at 28 to 28.5 volts by 2 voltage regulators in the navigator's junction box.

Two switches on the navigator's switch panel control the generators.

Reverse-current relays in the power panel



STORAGE BATTERY

junction box prevent a reverse flow of current, avoiding loss of battery charge when generator output is low.

Instruments for checking generator output are on the navigator's switch panel.

Inverters change direct current to alternating current for certain electrical units. These units are: radio compass, marker beacon, autosyn instruments, remote indicating compass, magnetic compass light, drift meter, bomb indicating lights, A-8 fluorescent lights, and heated clothing.

The inverter is a combination motor-generator. The 24-volt current drives the motor, which in turn drives the generator and produces 26-volt and 110-volt alternating current.

There is a combination inertia and direct-cranking starter on each engine. The motor is a part of the inertia system developing 22,000 rpm. This is reduced to 90 rpm for cranking the engine.

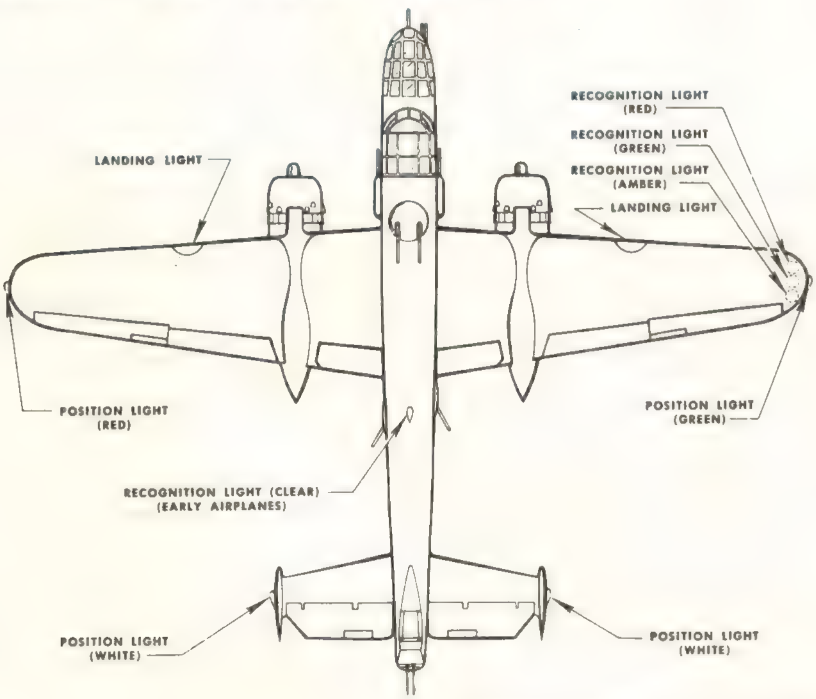
The current to the starter passes through the starter solenoid in the power panel junction box. This solenoid is operated by the energizing switch on the pilot's pedestal. After the inertia is built up, 2 jaws—one on the starter and one on the end of the engine crankshaft—transfer it to the engine. This action is accomplished by the meshing solenoid in the starter operated by the meshing switch on the pilot's pedestal.

These switches, used for both engines, are 3-position, spring-loaded switches.

Various circuits, switches, and fuses complete the system.

On late-model airplanes, circuit breakers replace the fuses in the electric system.

B-25 LIGHTING EQUIPMENT



Exterior Lighting

Landing Lights—An 8-inch, sealed-beam landing light is in the leading edge of each outer wing panel and is operated by a switch on the pilot's control pedestal.

Passing Light—Located beside the landing light in the left outboard wing panel, it is controlled by a switch on the pilot's switch panel (not installed on late series B-25).

Position Lights—The position lights consist of a red light on the outer edge of the left wingtip,

a green light on the outer edge of the right wingtip, and a white frosted light on the outboard surface of each vertical stabilizer. Two switches on the pilot's switch panel operate these lights. Each switch has an independent "BRIGHT" and "DIM" position for the wing and tail lights, separately controlled.

Formation Lights—The formation lights, colored blue, are mounted on the upper surface of the fuselage and horizontal stabilizer so they will not be visible from the ground. There are 3 lights aft of the upper turret on the center line of the fuselage and 4 lights on the horizontal stabilizer approximately 3 inches forward of the elevators. A rheostat, acting as both switch and intensity adjustment, controls all 7 lights (not installed on late series B-25's).

Recognition Lights—The recognition lights comprise a white lamp on the upper surface of the fuselage above the radio compartment, and red, green and amber lights on the lower surface of the right wingtip. A bank of 4 toggle switches on the left side of the pilot's control pedestal operates the lamps in any desired combination. They can be set to burn continuously or to flash off and on by means of a keying switch on the toggle switch box. **Caution: Do not keep the recognition lights on for more than a few seconds with the airplane on the ground, as serious damage to the lenses will result.**

Interior Lighting

Dome lights are located in the pilot's, bombardier's, navigator's, bomb bay, and radio compartments. The controls for the dome lights are in their respective compartments.

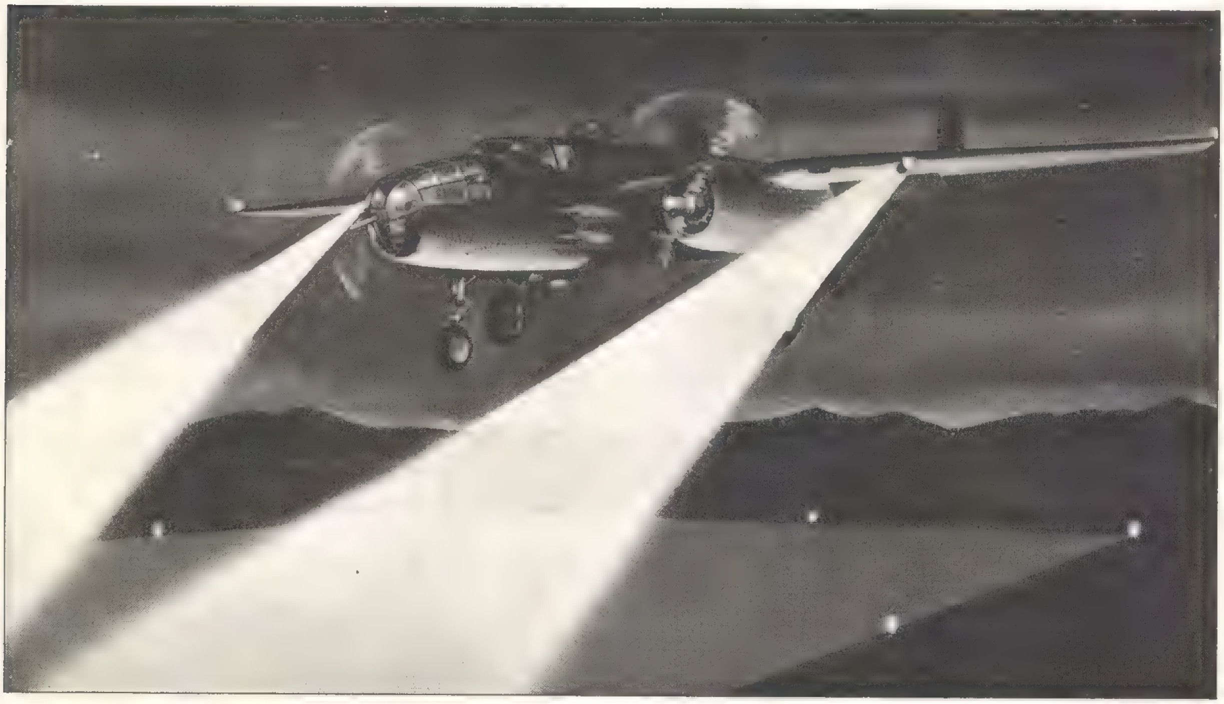
Extension lights are in the pilot's, bombardier's, and navigator's compartments. Switch controls of these lights are on each unit. They can be extended approximately 4 feet.

Instrument Lighting

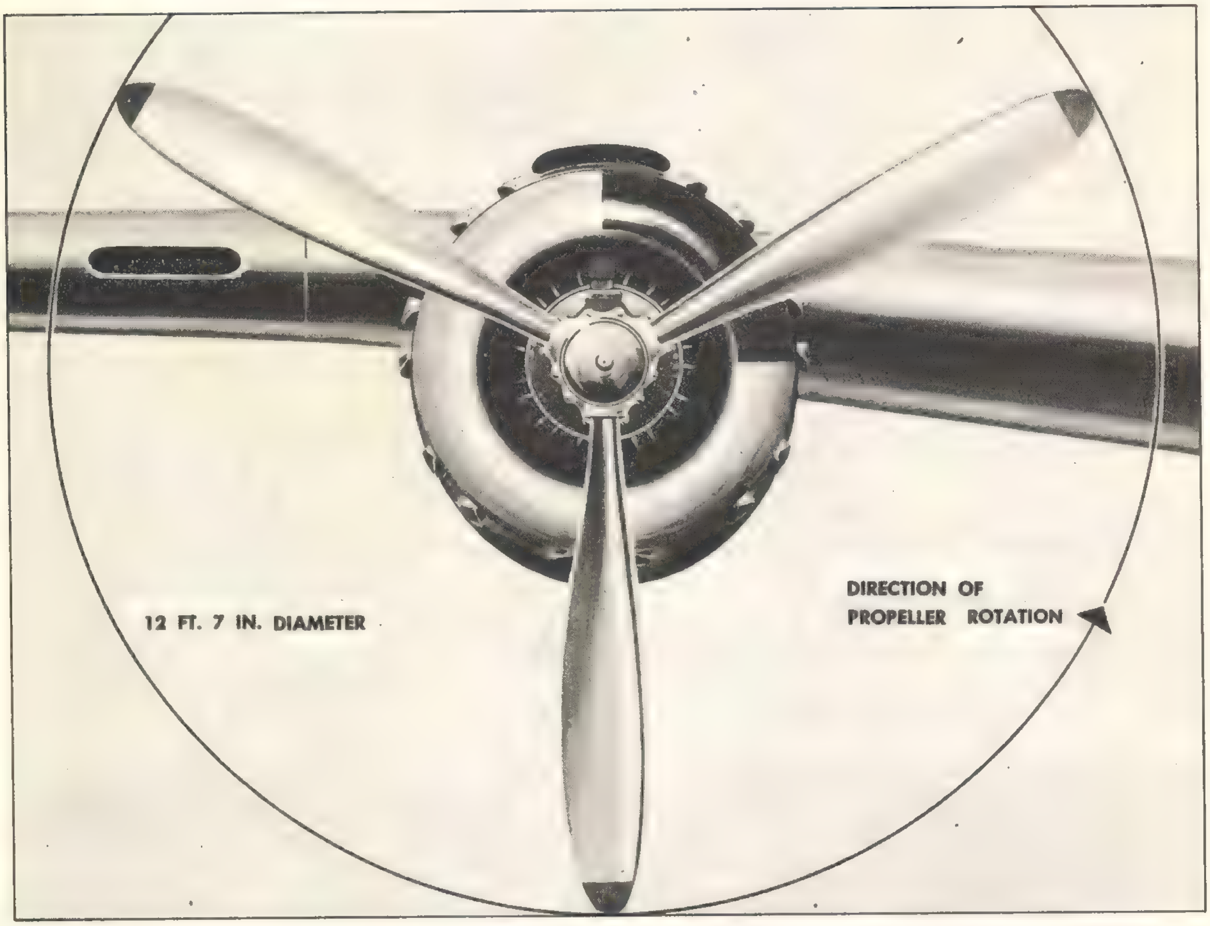
Fluorescent lamps are in the bombardier's compartment and on the pilot's and copilot's control columns. Intensity of these lights is adjustable by rheostats, adjacent to the lamps.

The pilot's magnetic compass light is in the compass itself; a rheostat on the pilot's switch panel controls it.

All optical gunsight lights are inside the sights. The rheostats which control them are near each unit.



HAMILTON HYDROMATIC PROPELLERS



The Hamilton hydromatic propellers of the B-25 are hydraulically operated. Their special features are automatic constant-engine-speed operation and the ability to feather and unfeather quickly in an emergency.

The actuating mechanisms operate in an oil bath, thereby minimizing wear and the chance of mechanical failure.

Constant-engine-speed control is achieved by an engine-driven governor metering oil to and from the actuating dome assembly.

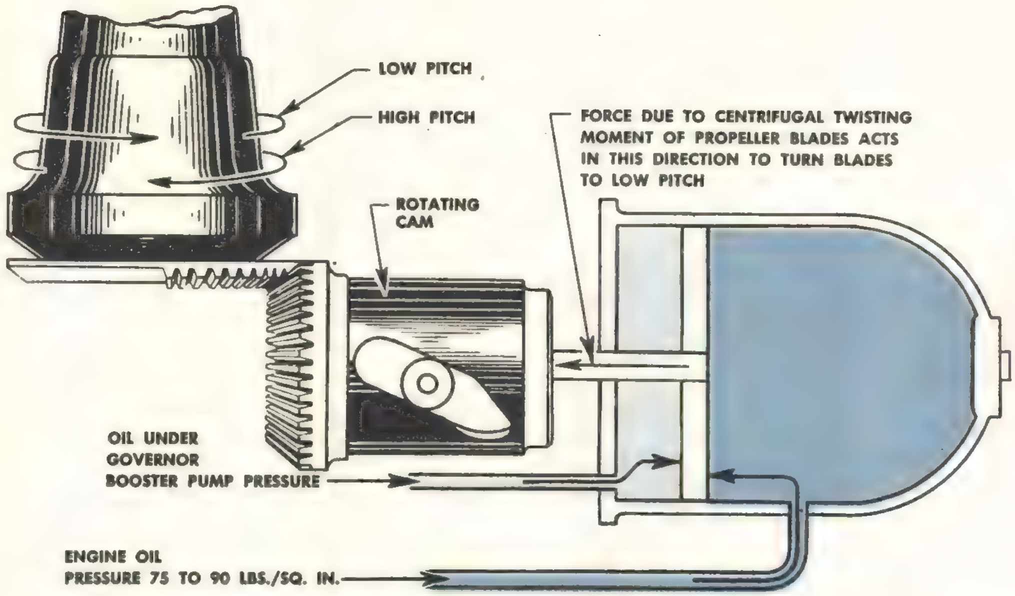
Engine oil, at pressures of from 25 lb. sq. in. at idling to 90 lb. sq. in. at maximum pressure goes to the outboard side of the piston. This pressure, plus the centrifugal twisting moment of the blades, reduces the blade angle.

Engine oil, boosted by a governor booster pump to 330-350 lb. sq. in. pressure, is metered into the inboard side of the piston to increase blade angle. (This pressure is stepped up to 400-425 lb. sq. in. on late series props.)

Feathering and unfeathering is accomplished by an independent auxiliary oil system controlled from the cockpit.

Principle of Operation

Angular blade movement of the propellers is obtained by converting the straight-line motion of the piston to circular movement by the cams. Oil pressure drives the piston back and forth.



Constant-speed Control

The propeller governor assembly maintains rpm settings established by the pilot.

The governor consists of 2 flyweights geared to the operation of the crankshaft. These flyweights adjust the load on the engine by raising or lowering a pilot valve which allows oil under pressure to be metered to the propeller dome, thereby increasing or decreasing the blade angle.

On-speed—An on-speed condition exists when the engine is turning at the selected rpm. The pilot valve has closed the pressure and drain ports in the governor, maintaining the blades at a fixed blade angle.

Overspeed—An overspeed condition indicates that the engine rpm has increased beyond the original setting. To counteract this condition, engine oil flows to the governor. There a booster pump increases pressure of the oil to 180-200 lb. per sq. in. Entry of this oil to the inboard side of the propeller dome is permitted when the pilot valve opens the pressure port, moving the piston forward and thus increasing blade angle and decreasing engine rpm.

Underspeed—An underspeed condition indicates that the engine is running slower than the selected rpm. To correct this, the pilot valve is forced downward, opening the drain port. Oil drains from the inboard side of the piston in the propeller dome. The centrifugal twisting moment of the blades, plus engine oil pressure on the outboard side of the piston, moves the blades to a lower angle, thus increasing engine rpm to the selected setting.

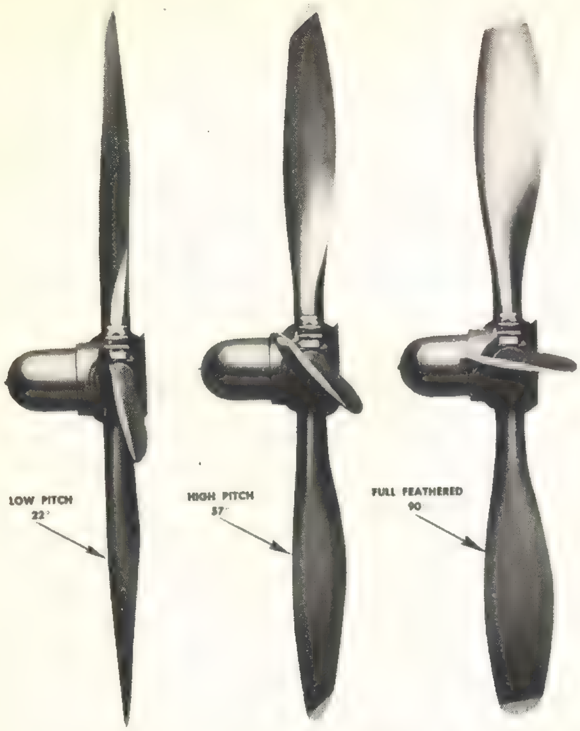
Feathering

You feather a propeller by actuating the feathering control button on the pilot's pedestal.

An electric feathering pump supplies oil at a maximum of 600 lb. sq. in. through a transfer valve. Through this valve the oil bypasses the governor to the propeller dome. Pressure is then built up on the inboard side of the piston, twisting the blades to the full-feathered position (90°). When the blades are at this angle, pressure increases sufficiently to operate a cut-out switch, disengaging the feathering pump.

Unfeathering

To unfeather a propeller hold the control button down. This operates the feathering pump, applying pressure through the same passages used for feathering. Since further travel



of the piston is no longer possible, oil pressure at 600 lb. sq. in. shifts a distributor valve to its outboard limit, which reverses the oil passages to the propeller dome. The pressure is now applied to the outboard side of the piston and moves it inboard, decreasing the blade angle. Hold control button down until the propeller is windmilling at 800 rpm. Then resume control in a normal manner.

HYDRAULIC SYSTEM

The hydraulic system provides quick and easy operation of the following equipment on the B-25:

Tricycle Landing Gear
Brakes
Wing Flaps
Cowl Flaps
Bomb Bay Doors
Automatic Pilot
Gun Chargers

The reservoir which contains the hydraulic fluid has a capacity of 5.9 gallons. A standpipe in the reservoir retains a reserve of 2.33 gallons for the emergency hand pump.

This reservoir, made of aluminum alloy, has a sight gage which shows the level of the fluid. The gage has only 2 markings—"FULL" and "REFILL." There is a removable screen in the filler neck which must be cleaned whenever the reservoir is re-serviced.

Two lines lead from the reservoir to a foam tank, built into the system to allow for expansion of the fluid caused by temperature changes. A vent line maintains constant atmospheric pressure in the system, allowing excess fluid or pressure bubbles to escape.

There is an engine-driven, gear-type, positive displacement pump in the accessory section below the right magneto of each engine. These pumps supply fluid pressure to the accumulators. They are connected in parallel. If one pump fails, the other will supply sufficient pressure to the system.

An emergency double-action, single-impulse hand pump, on the floor between pilot's and copilot's seats, supplies pressure to the system if both engine-driven pumps fail.

Two accumulators, located in the forward right corner of the navigator's compartment, store fluid under air pressure for the brakes and main hydraulic system. The accumulators also provide an air cushion in the system to absorb sudden changes in fluid flow.

These accumulators consist of a tubular steel housing into which is fitted a neoprene rubber boot. The boot is filled with air to a pressure of 400 lb. sq. in. The steel housing contains hydraulic fluid. When the fluid pressure exceeds 400 lb. sq. in. it compresses the air in the boot.

Fluid is pumped into the accumulators until the pressure is 1050 lb. sq. in. in the main system and 1150 lb. sq. in. in the brake system, sufficient for normal operation.

In late-series aircraft, pistons replace the rubber boots in the accumulators. The action is unchanged, however.

There are actuating cylinders at all points of the equipment where hydraulic pressure is converted into mechanical action.

This does not apply to the brakes, where toe pressure on the rudder pedals is converted into

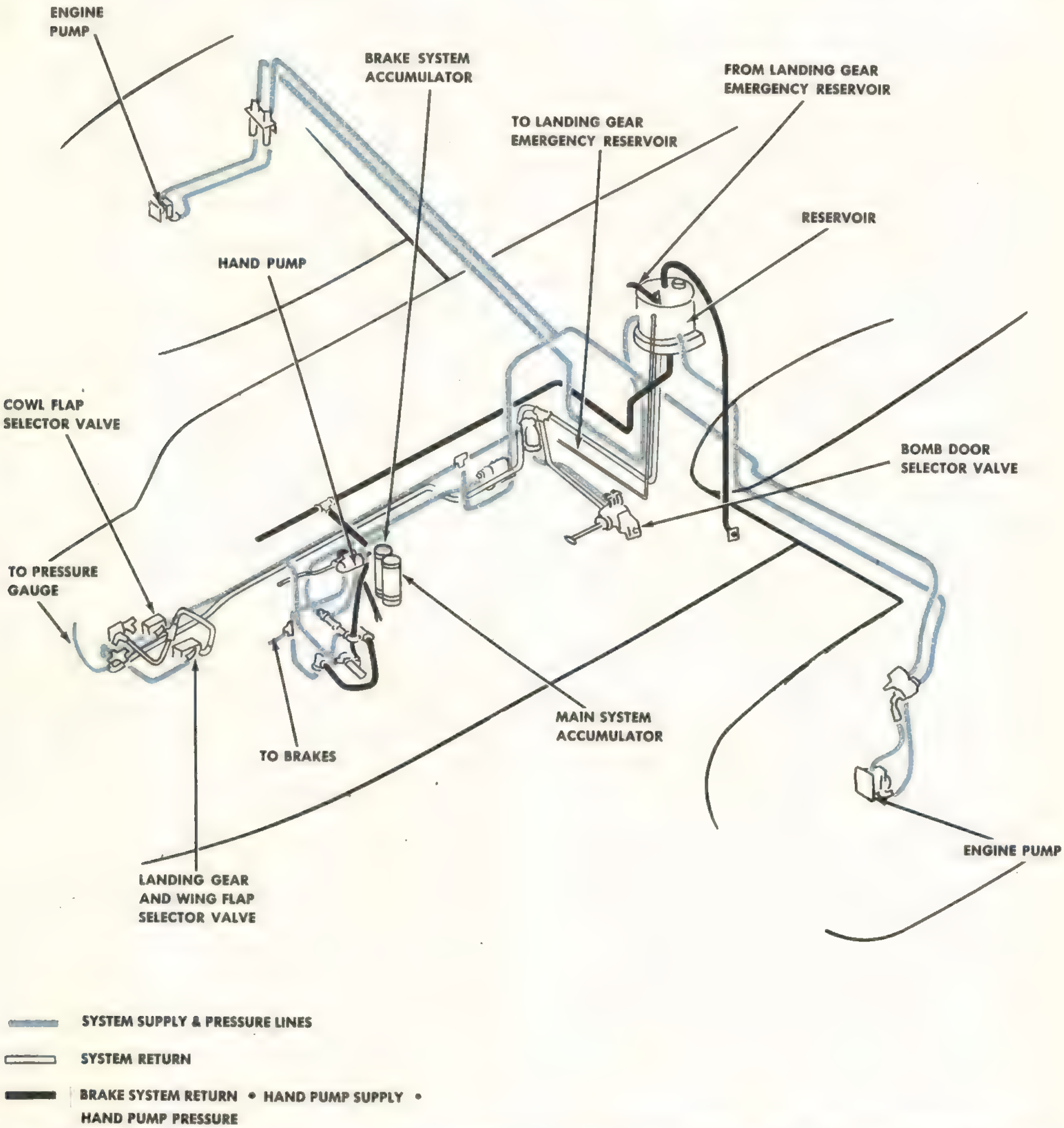
hydraulic pressure, which in turn supplies braking action through the power brake valve.

There is an emergency air brake system for use if the hydraulic brake system fails.

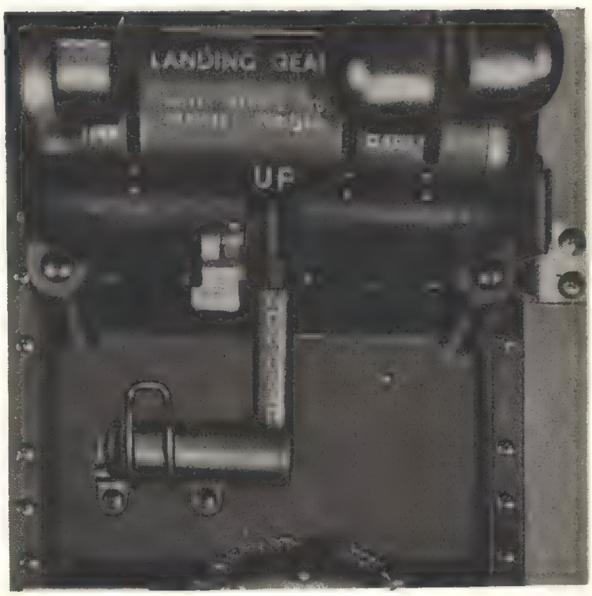
Note: These major changes in the B-25 hydraulic system are appearing on late series airplanes.

1. The carburetor heat rise system, formerly a mechanical linkage from the cockpit, is now controlled by the hydraulic system. (See Air Induction System.)

2. The emergency air brake system has been replaced with an emergency hydraulic brake system. (See Emergency Section.)



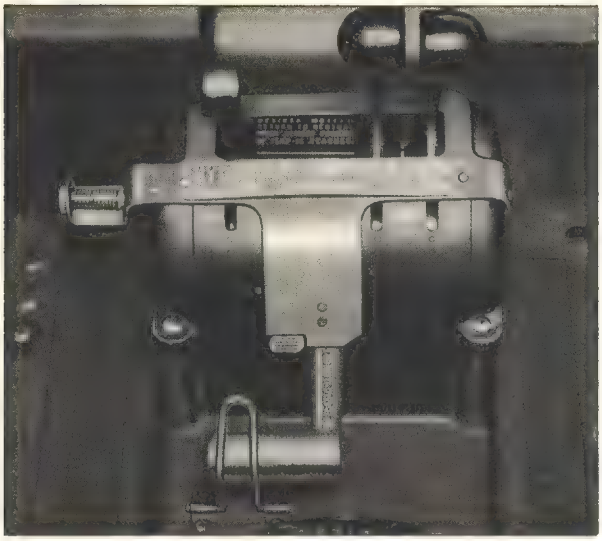
Landing Gear



The B-25 has retractable, tricycle landing gear, hydraulically operated. The landing gear retracts aft, the main gear into the engine nacelles, the nose gear into the fuselage. Doors cover the gear openings in both the retracted and extended positions.

The landing gear control handle is on the lower section of the pilot's control pedestal. Three distinct safety devices prevent accidental movement of the control handle:

1. A latch on the pedestal that must be set in the correct position before you can move the handle.
2. A wire hook fastened to the pedestal which is placed over the control handle whenever the handle is in the "DOWN" position.



3. A locking plate that the pilot attaches to the pedestal whenever he leaves the airplane.

The swivel-type nose gear strut incorporates a centering device. It functions when weight is removed from the nosewheel. There is a shimmy damper on the nosewheel strut to absorb the vibrations created in taxiing. The nosewheel may be released from the shimmy damper for towing purposes. A static ground wire is attached to the nosewheel.

There is a position indicator for the landing gear on the instrument panel. A warning horn, replaced on later models by a warning light, indicates whether landing gear is down and locked when throttles are retarded.

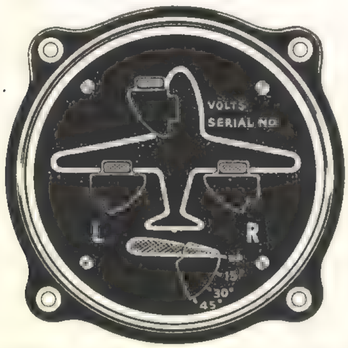
You can check the position of the main wheels visually from the cockpit. Check the position of the nosewheel visually by use of the drift meter or by removing the inspection plate from the floor in front of the copilot.

The nosewheel tire has a dual-seal tube, but the main wheel tires use regular tubes.

The main wheels have hydraulically operated, multiple-disc brakes. Varying pressures on the toe pedals produce braking action.

Conventional parking brakes permit setting the brakes in a locked position.

For emergency operation of landing gear and brakes, see Emergency Section.



LANDING GEAR UP AND LOCKED. FLAPS UP

LANDING GEAR PARTIALLY DOWN. FLAPS 15°

LANDING GEAR DOWN NOT LOCKED. FLAPS 15°

LANDING GEAR DOWN AND LOCKED. FLAPS 45°

INSTRUMENTS

The following instruments are installed on the B-25. You need no special instructions for their operation, as they are basically the same as those on any 2-engine bombardment or training airplane.

Flight Instruments

Pitot Static Instruments

1. Airspeed indicator
2. Sensitive altimeter
3. Rate-of-climb indicator

A static pressure selector valve on the instrument panel allows the pilot to use an alternate source of static pressure from inside the airplane. Use this when the static side of the pitot tube fails because of damage or unusual air conditions, such as might be encountered during a thunderstorm.

Vacuum Instruments

Vacuum pumps, one on each engine, supply the pressure to operate these instruments and also the autopilot and the de-icer boots.

1. Artificial horizon
2. Directional gyro
3. Bank-and-turn indicator

A bank-and-turn needle-valve control on the instrument panel allows adjustment of the suction pressures operating the gyro of the bank-and-turn indicator. Flight tests on this instrument should give a standard-rate turn (90° in 30 seconds) at one needle-width deflection. Adjust the suction pressures until this deflection is accurate.

Engine Instruments

1. Cylinder-head temperature gage
2. Oil temperature gage
3. Oil pressure gage
4. Fuel pressure gage
5. Tachometer
6. Manifold pressure gage
7. Carburetor air temperature gage

Miscellaneous Instruments

1. Suction gage
2. Clock
3. Magnetic compass
4. Remote compass indicator
5. Radio compass indicator
6. Hydraulic and brake pressure indicators
7. Fuel gages
8. Free air temperature gages
9. Air pressure gages—for the emergency air brake system and the hydraulic accumulators.
10. Oxygen regulators
11. Nosewheel warning lights
12. Landing gear and flap position indicator—this is a resistance-type indicator.

A contact, linked to the landing gear and flaps, moves across the arc of a resistor as you operate the gear and flaps. Thus the resistance varies and is converted to an indication of position on the instrument dial.

Autosyn Instruments

Autosyn instruments are electrically operated. Each instrument consists of two motors, one of which is a transmitter and the other an indicator. The transmitter is located at the source of mechanical energy, the indicator on the instrument panel. The two motors are synchronized so that the speed of the motor at the source governs the speed of the motor at the indicator, and gives an accurate reading.

The most common autosyn installations are:

Fuel pressure
Oil pressure
Manifold pressure
Tachometer
Remote reading compass

On late series aircraft, pressure transmitting instruments replace all autosyn instruments, except the remote reading compass.

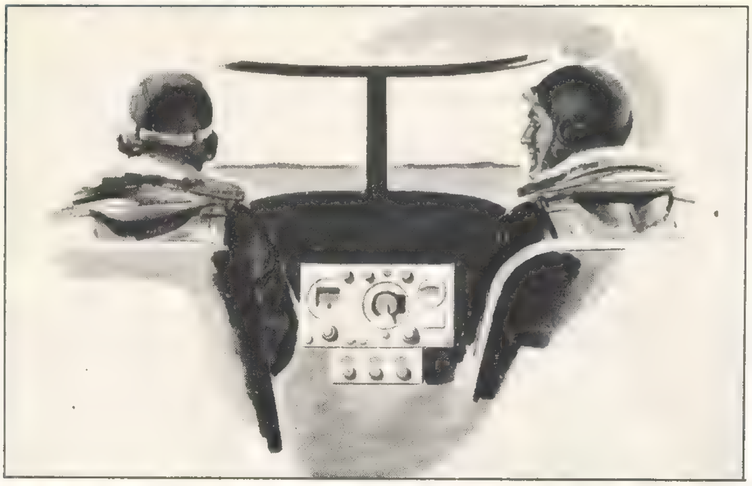
Pressure Transmitting Instruments

Pressure forces in the pressure transmitting instruments actuate a diaphragm. This diaphragm transmits the pressure through a line filled with compass fluid to an indicator on the instrument panel, where it is converted to the desired reading.

The pressure transmitting instruments on the B-25 are fuel pressure and oil pressure.

Aircraft with these instruments have direct reading manifold pressure gages and electric tachometers.

AUTOMATIC PILOT



Most B-25's have A-3 or A-3A autopilots which operate on a pneumatic-hydraulic principle. They fly the airplane automatically in straight and level flight and make the necessary corrections for holding a given course or altitude. They do this by utilizing the indications of the directional gyro control unit and the bank and climb control unit.

The difference between the human pilot and the autopilot is that the autopilot acts instantaneously and with a precision not possible for a human pilot.

The reaction time of the human pilot is always governed by such factors as fatigue, muscle coordination and a failure to detect errors the instant they occur.

The autopilot however, corrects instantaneously for any deviation from the set course. Properly adjusted, it will neither overcontrol nor undercontrol the airplane, but will keep it flying straight and level with all controls operating in complete coordination.

How It Works

The principle of operation of the autopilot is the same for correcting all off-movements.

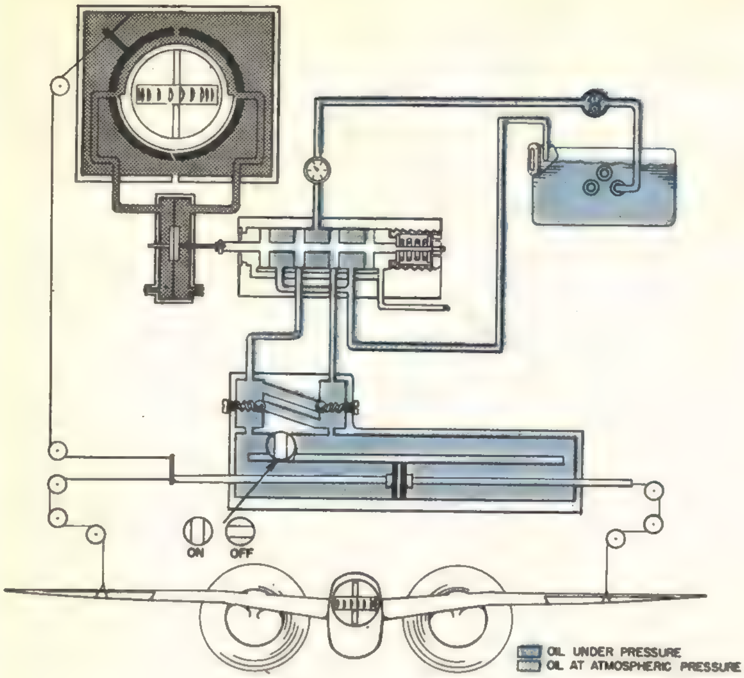
Suppose that an airplane is in straight and level flight and that the autopilot is operating. So long as the airplane continues to fly straight and level, equal amounts of air pass through two channels around the spinning wheel of the bank-and-climb control unit.

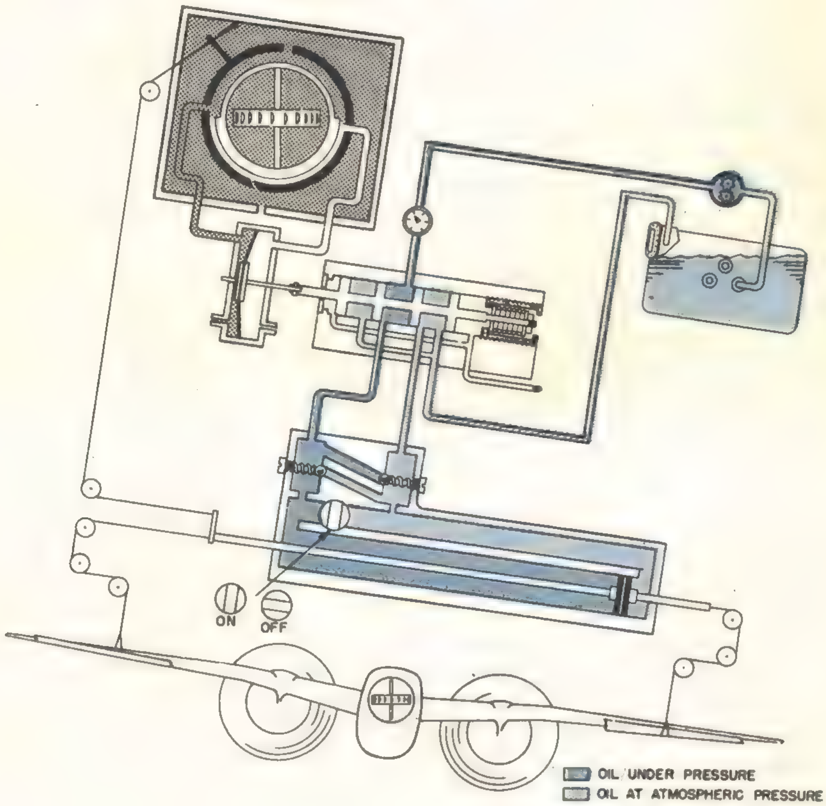
Suddenly rough air causes one wing to drop. Immediately, a ring around the spinning wheel shuts air off from one of the channels. This unequalizes the air in the relay chamber of the bank-and-climb control unit, depressing the diaphragm which divides the relay chamber. When the diaphragm is depressed, a balanced oil valve opens and permits oil to flow to the hydraulic control cylinders. The pressure of this oil actuates a piston connected to the aileron cables. The piston moves forward or backward until the plane is righted.

The flow of oil from the hydraulic cylinder is regulated by speed adjustment knobs on the automatic pilot assembly. You can vary the speed of correction by increasing or decreasing the volume of flow. You can also overpower the automatic pilot by applying increased pressure to the controls. Spring-loaded relief valves in the hydraulic cylinders permit this overpowering action if it becomes desirable.

An automatic follow-up mechanism is part of the automatic pilot. It eases the pressure on the controls as the airplane starts to recover. When the plane is again in level flight, the action of the follow-up mechanism equalizes the pressure in the air relay chamber and cuts off the oil supply.

You can disengage the automatic pilot quickly, if necessary, by a control on the pilot's pedestal. This control is connected by a cable to a bypass valve in the hydraulic cylinder.


ON
OFF
OIL UNDER PRESSURE
OIL AT ATMOSPHERIC PRESSURE


ON
OFF
OIL UNDER PRESSURE
OIL AT ATMOSPHERIC PRESSURE

OPERATING THE AUTOPILOT

1. Rudder Control Knob
2. Rudder Follow-up Card
3. Directional Gyro Card
4. Ball Bank Indicator
5. Caging Knobs
6. Installation Bolts
7. Banking Scale
8. Horizon Bar
9. Miniature Airplane
10. Horizon Dial
11. Directional Gyro Unit
12. Bank and Climb Gyro Unit
13. Valve Adjustment Reference Dials
14. Valve Adjustment Knobs
15. Miniature Airplane Adjusting Knob
16. Elevator Alignment Index
17. Elevator Follow-up Index
18. Suction Gage
19. Elevator Control Knob
20. Aileron Follow-up Index
21. Bank Index
22. Aileron Control Knob

It's okay to let Elmer take over and do some of your flying for you, particularly to relieve you of the strain caused by long over-water flights. Or, if you are cruising over the top and need to be very accurate in your cross country courses, let Elmer fly.

Remember, though, that the autopilot is a machine. It cannot do your thinking for you. Use it as an aid to flight, not to do your flying and particularly not your thinking.

Experience has demonstrated that the instantaneous control responses of the autopilot under flight conditions which might cause sideslip or stall, may result in a spin. Because of this, the following restrictions are placed on its use.

Do not use it in extremely turbulent air. You can, if you choose, use it to aid you but you must be on the controls also.

Do not use it when the de-icer system is in operation.

Do not use it if both engines are not delivering normal power.

Do not turn it on until you are sure that flight conditions permit safe control by the autopilot.

Maintain at least minimum cruise power settings. The B-25 is too sluggish at low speeds to permit safe operation on autopilot.

Never operate the autopilot unless one rated pilot is on watch in the cockpit. You must constantly check the instruments, and the trim of the plane must be accurate.

Never engage the autopilot unless the indices are lined up properly.

Never make course and altitude changes rapidly with the autopilot.

When the autopilot is engaged, never turn the speed valves to "O" setting. This will lock the corresponding surface controls in their position.

Ground Checklist

Check suction—3.75" to 4.25" Hg.

Check oil pressure—75 to 90 lb. sq. in.

Check bank-and-climb unit uncaged.

Check directional unit uncaged.

Engage autopilot and check operation by moving each control knob. Watch the surface controls for corresponding movements.

Check for air in the Servo units by moving the normal surface controls. A springy reaction shows the presence of air in the system.

Disengage autopilot, leave gyros uncaged.

In Flight

Trim the plane hands-off.

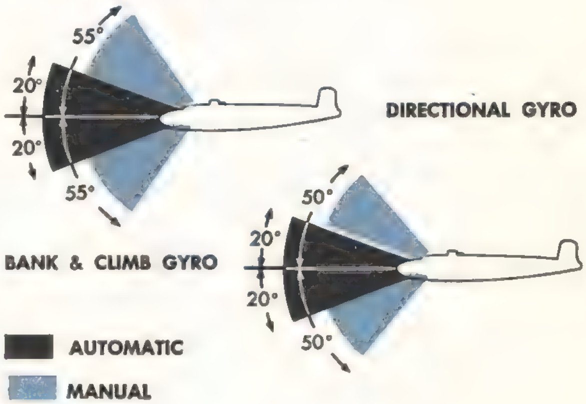
Set Servo controls at No. 4.

Set rudder follow-up card to match directional gyro card.

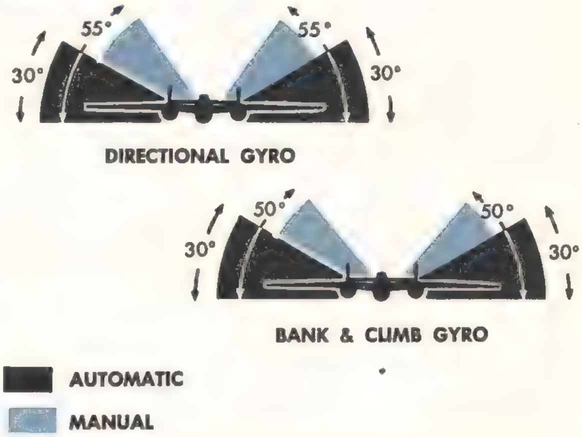
Set aileron follow-up card to match bank index.

Operating Limits

CLIMBING OR GLIDING



BANKING



Set elevator follow-up card to match elevator alignment index.

Caution—Do not set the elevator follow-up card to match the horizon bar. Their relative movement is in opposite directions.

Move the "ON-OFF" control to the "ON" position slowly.

Adjust the Servo speed controls as needed.

These controls are calibrated from 0 to 8, the speed range of operation is 0 (locked) to 8 (high speed reaction). If the instrument is in good condition, the proper setting for the B-25 is between 2 and 4. These need not read the same for all controls.

Set fore and aft attitude with the elevator knob.

Set directional control with the rudder knob.

Set in bank when you wish to turn more than 5°.

Always keep the gyros uncaged except during maneuvers which exceed the operating limits of the autopilot. These are 50° from the vertical for the bank-and-climb unit and 55° for the directional gyro unit.

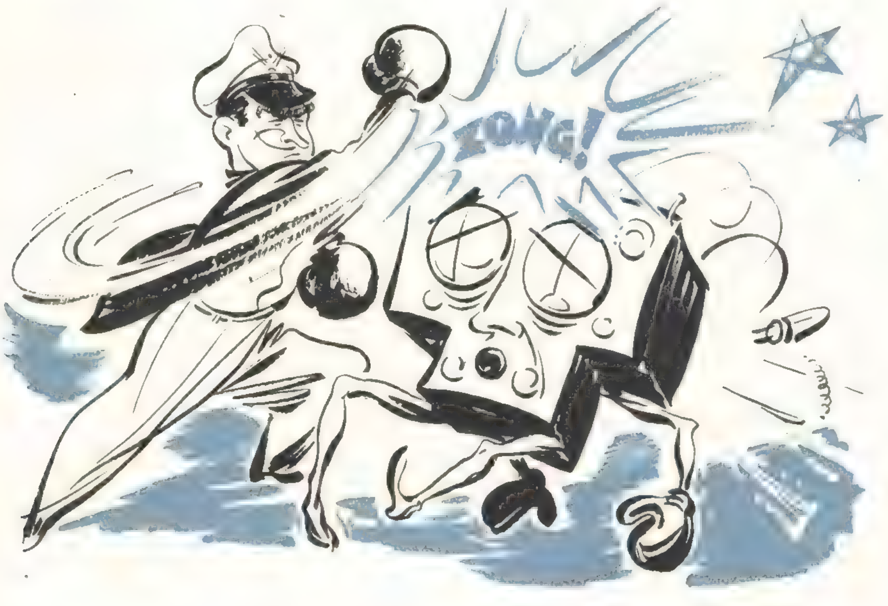
Warning

During flight do not overcontrol the autopilot more than 15°. This causes the autopilot to attempt an abrupt return to the original position, with possible damage to the control surfaces and the autopilot.

The autopilot gives accurate control with a plus or minus tolerance of 1°. It flies a far better course than a human pilot.

When the autopilot is in use for extended periods, be sure to disengage it at least once every half hour to check the trim manually. This instrument will not give efficient performance if it is operating against the pressures of the trim tabs.

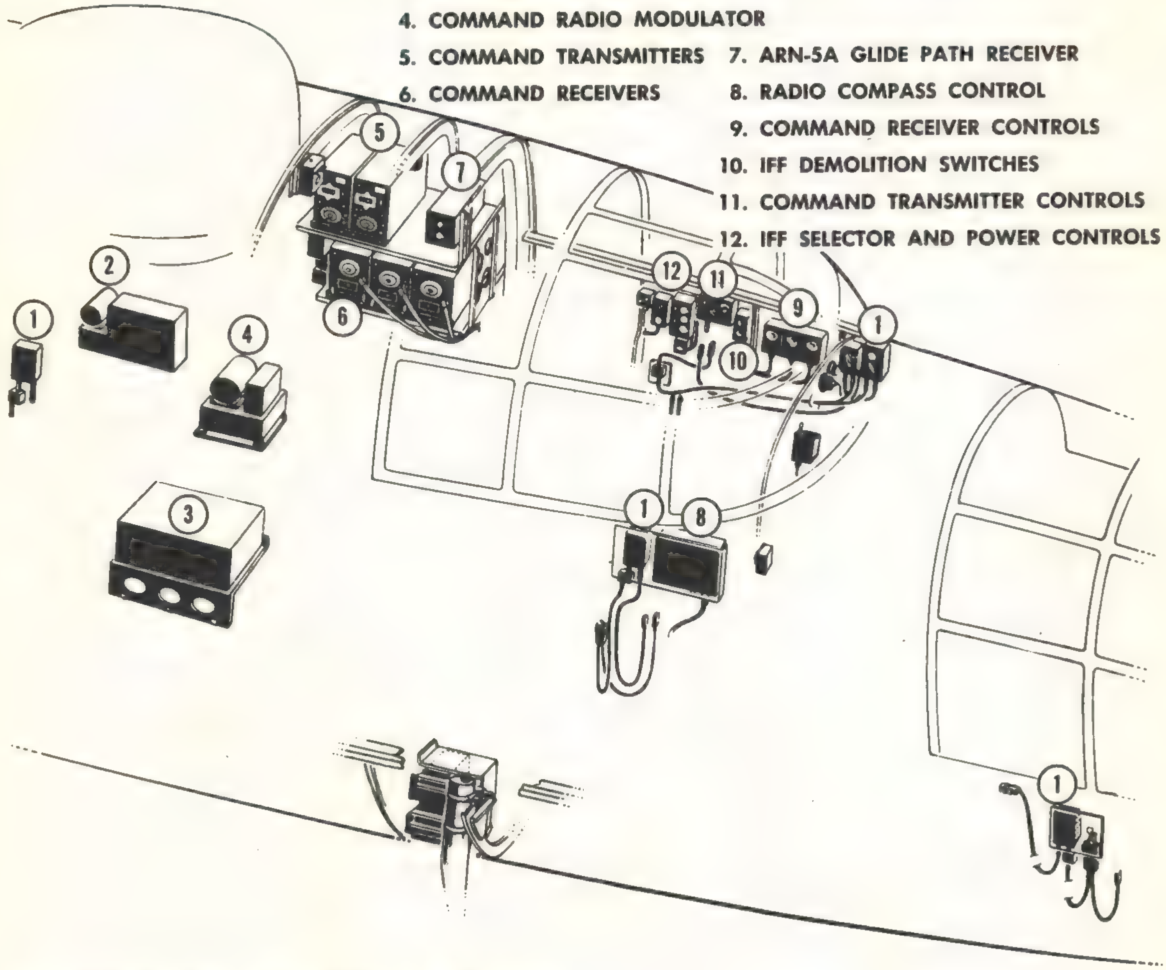
If the Servo speed controls are improperly set, the plane oscillates or hunts for a stable position. If this happens, open the Servo speed controls and slowly turn them toward the closed position. Do not close them completely, but find the point at which the oscillation stops. Adjust the controls slowly back and forth at this point until you obtain the desired setting.



ALWAYS BE SURE YOU CAN OVER POWER THE AUTOPILOT MANUALLY. TRY IT ON THE GROUND BEFORE YOU FLY.

COMMUNICATION EQUIPMENT

1. INTERPHONE JACK BOXES
2. RUNWAY LOCALIZER RECEIVER
3. RADIO COMPASS RECEIVER
4. COMMAND RADIO MODULATOR
5. COMMAND TRANSMITTERS
6. COMMAND RECEIVERS
7. ARN-5A GLIDE PATH RECEIVER
8. RADIO COMPASS CONTROL
9. COMMAND RECEIVER CONTROLS
10. IFF DEMOLITION SWITCHES
11. COMMAND TRANSMITTER CONTROLS
12. IFF SELECTOR AND POWER CONTROLS



The communication equipment on the B-25 is basically the same as that on all Army bombardment airplanes.

The following radio sets are installed:

Command set
Liaison set
Radio compass receiver
Marker beacon receiver
Interphone system
VHF (Very High Frequency)

Tactical use of the B-25 requires the installation of IFF equipment. Special training in this equipment will be given when missions require its use.

Command Set

The command set has 2 transmitters with a range of 4 to 5.3 Mc on one transmitter and a range of 7 to 9.1 Mc on the other.

Three receivers cover ranges of 190 to 550 Kc, 3 to 6 Mc, and 6 to 9.1 Mc. Selective use of these ranges is made by switching one or all of the receivers "ON."

The command set allows transmission and reception by voice and code for air-to-air and air-to-ground stations over short ranges.

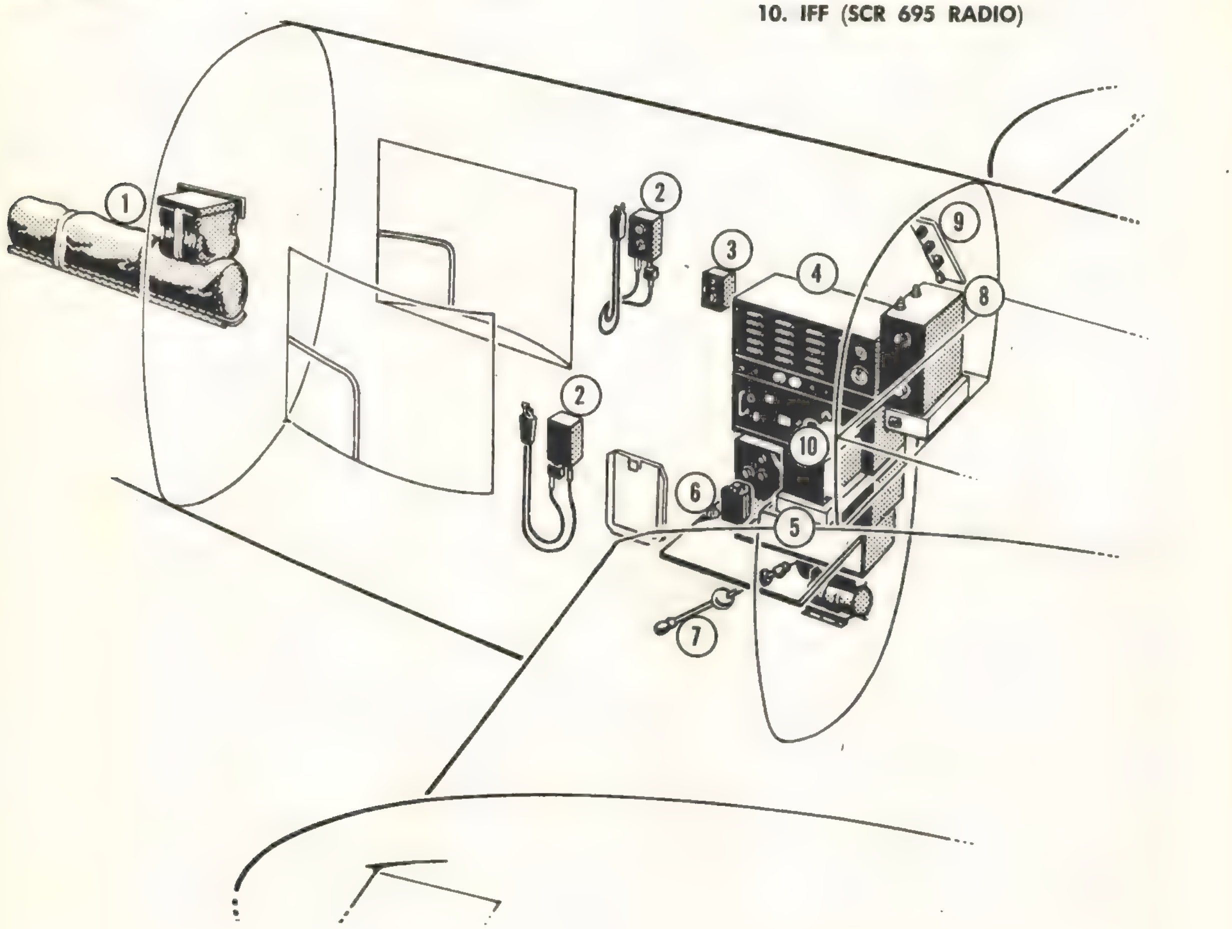
Liaison Set

The liaison set has one transmitter with 7 interchangeable tuning units, covering frequency ranges of 150 to 600 Kc and from 1500 Kc to 12,500 Kc.

The set has one receiver capable of reception of voice, tone, or CW signals over a range of 150 to 18,000 Kc.

A radio operator uses this set for long-range air-to-ground communication. In emergencies the pilot, copilot, and navigator, by using the interphone circuits, can transmit voice messages to the ground.

1. DINGHY RADIO ASSEMBLY
2. INTERPHONE JACK BOXES
3. TRAILING ANTENNA CONTROL BOX
4. LIAISON TRANSMITTER
5. LIAISON RECEIVER
6. LIAISON OPERATING KEY
7. TRAILING ANTENNA
8. ANTENNA TUNING UNIT
9. LIAISON ANTENNA SWITCH
10. IFF (SCR 695 RADIO)



Radio Compass Receiver

The radio compass receiver has 2 control stations, one in the pilot's compartment and one in the navigator's compartment.

Operating on either a fixed antenna or a rotating loop antenna, it indicates direction of incoming signals. It covers a range of 200 to 1750 Kc.

For detailed instructions in the use of this equipment see T. O. No. 30-100 series.

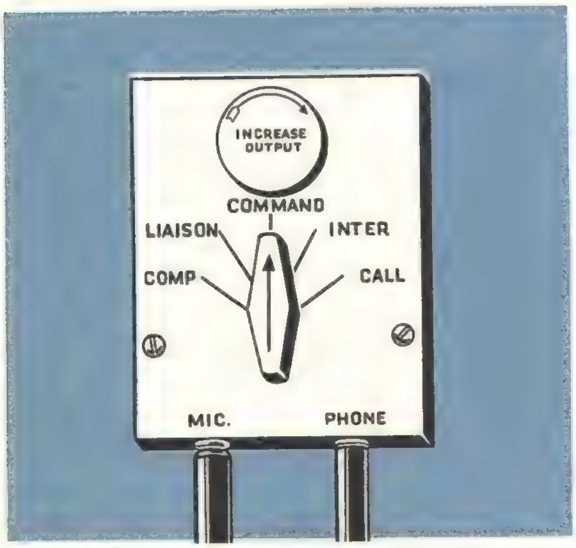
Marker Beacon Receiver

The marker beacon receiver is a specialist. It performs only one job. Operating on a frequency of 75 Mc, it detects signals transmitted by fan marker beacons, and by Z marker beacons operating in the cones of silence. A blinking light on the instrument panel is connected to the receiver, blinking on when the airplane passes a 75 Mc transmitter.

Interphone

The interphone system of the B-25 is a standard installation. It operates whenever the battery-disconnect switches are "ON." It is used by every crew member to communicate with all other crew members.

The interphone plays a vital part in crew coordination. Used effectively in combat, it serves as the eyes of the entire crew.



INTERPHONE JACK BOX

RADIO SET SCR 522 A

The SCR 522 A VHF (very high frequency) transmitter-receiver radio set provides 2-way radio-telephone communication between aircraft in flight and between aircraft and ground stations. Provision is made for voice communication and continuous audio-tone modulation.

The pilot and co-pilot control the SCR 522 by means of the radio control box on the right side of the pilot's control pedestal in the B-25. The set operates on any one of 4 pre-set crystal-controlled frequency channels lying within the range of 100-156 Mc. Line-of-sight communication is normally necessary for satisfactory operation of the radio set.

The following table lists the approximate range to be expected, assuming communication is taking place between the aircraft and a ground station over level country.

ALTITUDE	RANGE
1000 FEET	30 MILES
3000	70
5000	80
10,000	120
15,000	150
20,000	180

Radio Control Box

The radio control box to the right of the pilot's control pedestal provides the only complete remote control of communications functions. Five red push buttons are the means by which any one of the 4 channels (A, B, C, and D) is

selected and the power turned off. When the "OFF" push button is pressed, the dynamotor is stopped. The push buttons are interconnected so that not more than one channel can be selected at a given time. A light opposite each push button indicates which channel is being used.

The "T-R-REM" switch (transmit-receive-remote) is normally in the "REM" position, permitting press-to-talk operation by means of the conventional push button microphone switch on the pilot's control wheel, which when depressed switches the equipment from **receive** to **transmit**. In the "T" position the transmitter is in continuous operation. In the "R" position the receiver is in continuous operation.

The lever tab, directly above the "T-R-REM" switch, when lowered, blocks the switch from "REM" position and spring-loads the switch lever so that unless it is held in the "T" position it will return to "R."

The small lever tab opposite the "OFF" push button is a dimmer mask to reduce the lamp glare. The lamp opposite the "T-R-REM" switch is on when receiving and off when transmitting.

Transmitter-Receiver Assembly

The transmitter and receiver units are in a single case. The transmitter employs a crystal-controlled oscillator circuit and operates in the frequency range of 100-156 Mc on one of the 4 pre-set channels A, B, C, and D. Average output power of the transmitter is 8 to 9 watts, using a total power input current of 11.5 amps at 28 volts.

The receiver is a sensitive superheterodyne unit employing a heterodyne oscillator whose frequency is controlled by any one of 4 quartz crystals. Thus the 4 crystal-controlled channel frequencies within the range 100-156 Mc are available for instantaneous selection at the remote control position. For reception the total input current is 11.1 amps at 28 volts.

Dynamotor Unit

The dynamotor operates on the 28-volt power circuit and supplies 3 regulated voltage sources (300-volt DC, 150-volt DC, and 13-volt DC) required for operation of the transmitter-receiver assembly.

In addition to the equipment listed above, jackboxes, junction boxes, headsets, and microphones are used with the radio set.

Operation of the SCR 522 A

1. **Transmission only**

To start the equipment, press push button A, B, C, or D depending upon which channel is to be used.

Allow approximately one minute for the vacuum tubes to warm up.

Move the "T-R-REM" switch to the "T" position and speak into the microphone.

2. **Reception only**

Place the "T-R-REM" switch in the "R" position. It is held in the "R" position by lowering the small lever tab.

To start the equipment press push button A, B, C, or D for the desired channel.

3. **Press-to-transmit (press-to-talk) operation**

Place the "T-R-REM" switch in the "REM" position.

To start the equipment select a channel by pressing push button A, B, C, or D.

To receive: Under these conditions the receiver is normally in continuous operation.

To transmit: Depress the press-to-talk button and speak into the microphone.

To receive again: Release the press-to-talk microphone button.

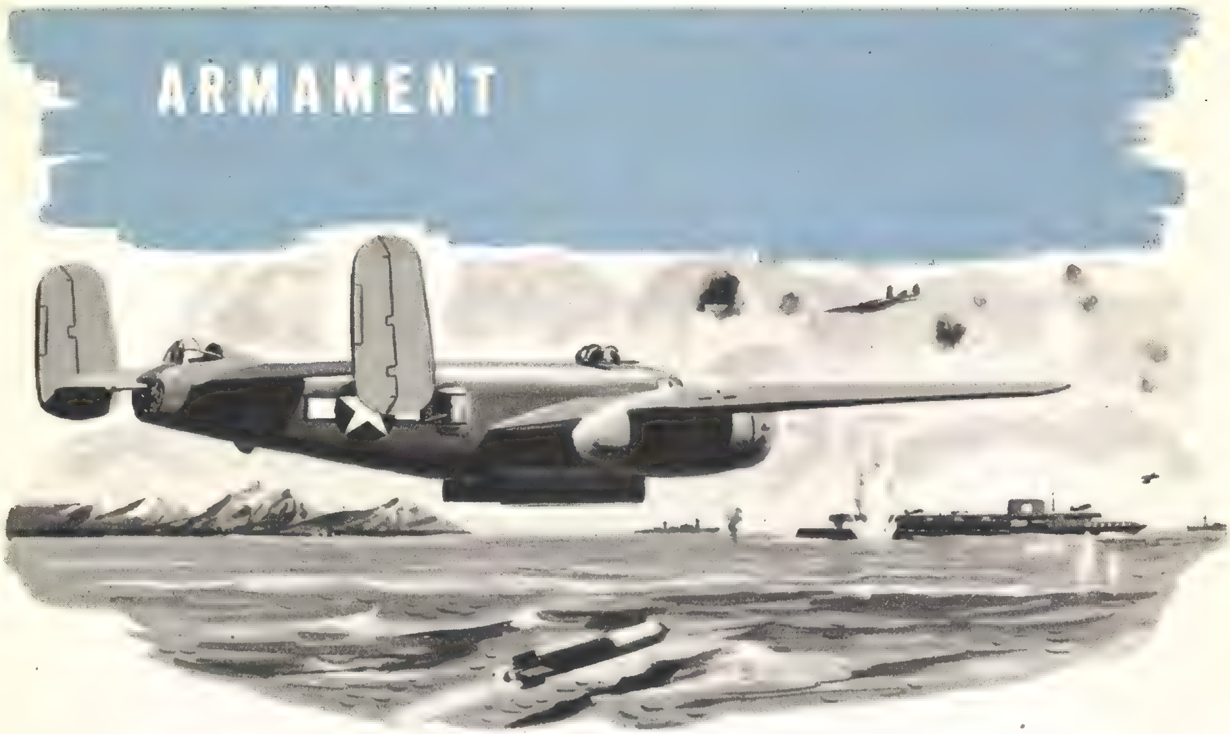
4. **To shut off the equipment,** press the "OFF" button.

Precautions During Operation

Avoid prolonged use of the radio on the ground to conserve the batteries and avoid overheating of the dynamotor.

If the transmitter and receiver fail to operate when a channel push button is pressed on the radio control box, press another channel push button, then again press the push button for the desired channel. Transmission and reception should now be possible.

ARMAMENT



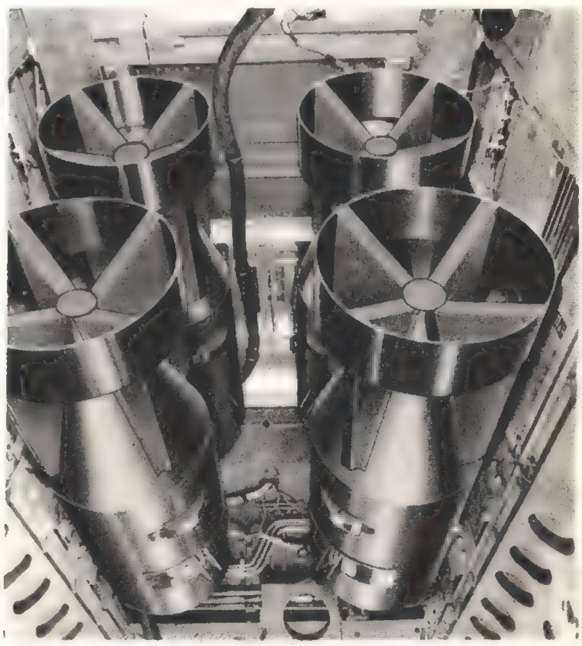
The armament of the B-25 follows basically the same pattern found in any AAF bombardment airplane. The detailed installation varies greatly according to the tactical uses intended. Safe handling and operation require thorough knowledge and practice on this equipment, under the supervision of a competent instructor.

Bombing

The bomb bay, between the navigator's and the radio operator's compartments, has fixed ladder bomb racks which accommodate 100-lb. to 1600-lb. bombs. A special rack may be installed to carry one 2000-lb. bomb. The control system is electric and most of the system is dual wired as a precaution against damage by gunfire. Wing racks may be installed on the outer wing panels to carry 8 bombs of from 100 lb. to 300 lb., or 6 325-lb. depth charges.

Controls for operating the bomb bay doors and bomb releases are in the bombardier's compartment.

On the B-25 G. and H, the bomb bay and bombing controls are in the pilot's compartment.



On the B-25 J, the bombardment controls are in both the bombardier's and pilot's compartments.

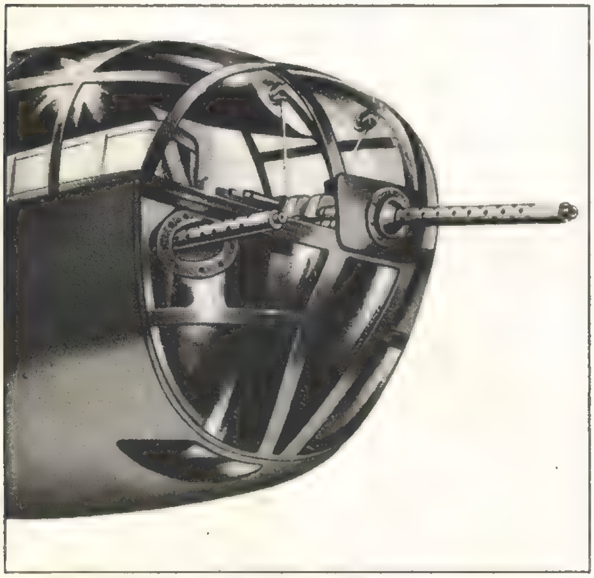
Controls in the pilot's compartment will salvo the bomb load and the droppable bomb bay tank. The fixed fuselage tank carried in the top of the bomb bay cannot be salvoed.

Provision is made for carrying a torpedo as an alternate bomb load. Use of the torpedo precludes bomb loads in the bomb bay, but does not limit the use of external wing racks.

Chemical spray tanks may be carried in the bomb bay and on the wing racks when necessary.

Gunnery

Gunnery equipment varies greatly in different series airplanes. They are as follows: **B-25 C and D.**



One fixed .50-cal. nose gun is mounted on the right side of the bombardier's compartment. The pilot fires this gun and the bombardier charges it. There is a type N-3B optical gunsight on the upper left side of the instrument panel.

One flexible .50-cal. nose gun, in a ball-and-socket mount, is directly above the bombsight window. The bombardier fires this gun, which has a ring-and-post sight.

There is an electrically powered Bendix upper turret in the radio gunner's compartment. This turret carries two .50-cal. guns fired by either the radio operator or the gunner, and has a type N-6A optical gunsight.

B-25 G

One 75-mm. cannon (type M-4) is in the tunnel beneath the left side of the pilot's compartment and fires through the nose. The pilot fires the cannon and the cannoneer loads it. There is a type N-3B optical gunsight on the left side of the pilot's instrument panel for the forward-firing guns.

Two forward-firing, .50-cal. fixed guns are in the nose. The pilot charges and fires these guns.

There is a Bendix upper turret in the radio gunner's compartment. It carries two .50-cal. guns, fired by either the radio operator or the gunner, and has a type N-6A optical gunsight.

A few modified G's carry flexible .50-cal. waist guns, blister guns, and one flexible .50-cal. tail gun.

B-25 H

One 75-mm. cannon (type T-13) is in the tunnel beneath the left side of the pilot's compartment and fires through the nose. The pilot fires the cannon and the cannoneer loads it. A type N-3B optical gunsight for the forward-firing guns is on the left side of the pilot's instrument panel.

Four forward-firing, .50-cal. fixed guns are in the nose section. The pilot fires these guns, which are charged in the navigator-cannoneer's compartment.

Two or four fixed .50-cal. guns are mounted in blisters on each side of the plane. The cannoneer charges these guns and the pilot fires them.

A Bendix upper turret, in the aft portion of the cannoneer's compartment, carries two .50-cal. guns, fired by the engineer, and has an N-6A gunsight.

Two flexible .50-cal. guns in Plexiglas windows, one at each side of the fuselage aft of the bomb bay, are fired by the radio operator. They have ring-and-post sights.

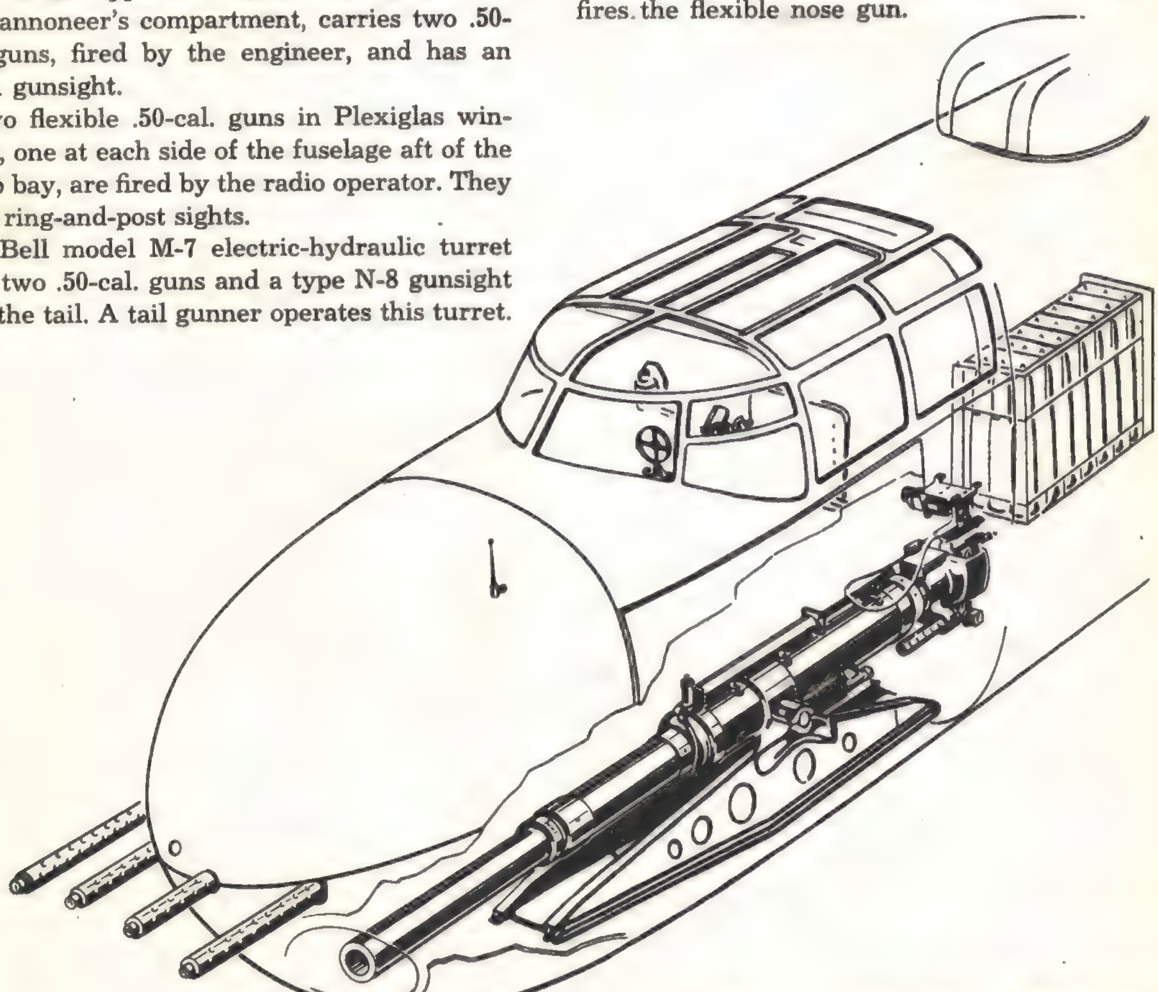
A Bell model M-7 electric-hydraulic turret with two .50-cal. guns and a type N-8 gunsight is in the tail. A tail gunner operates this turret.

B-25 J

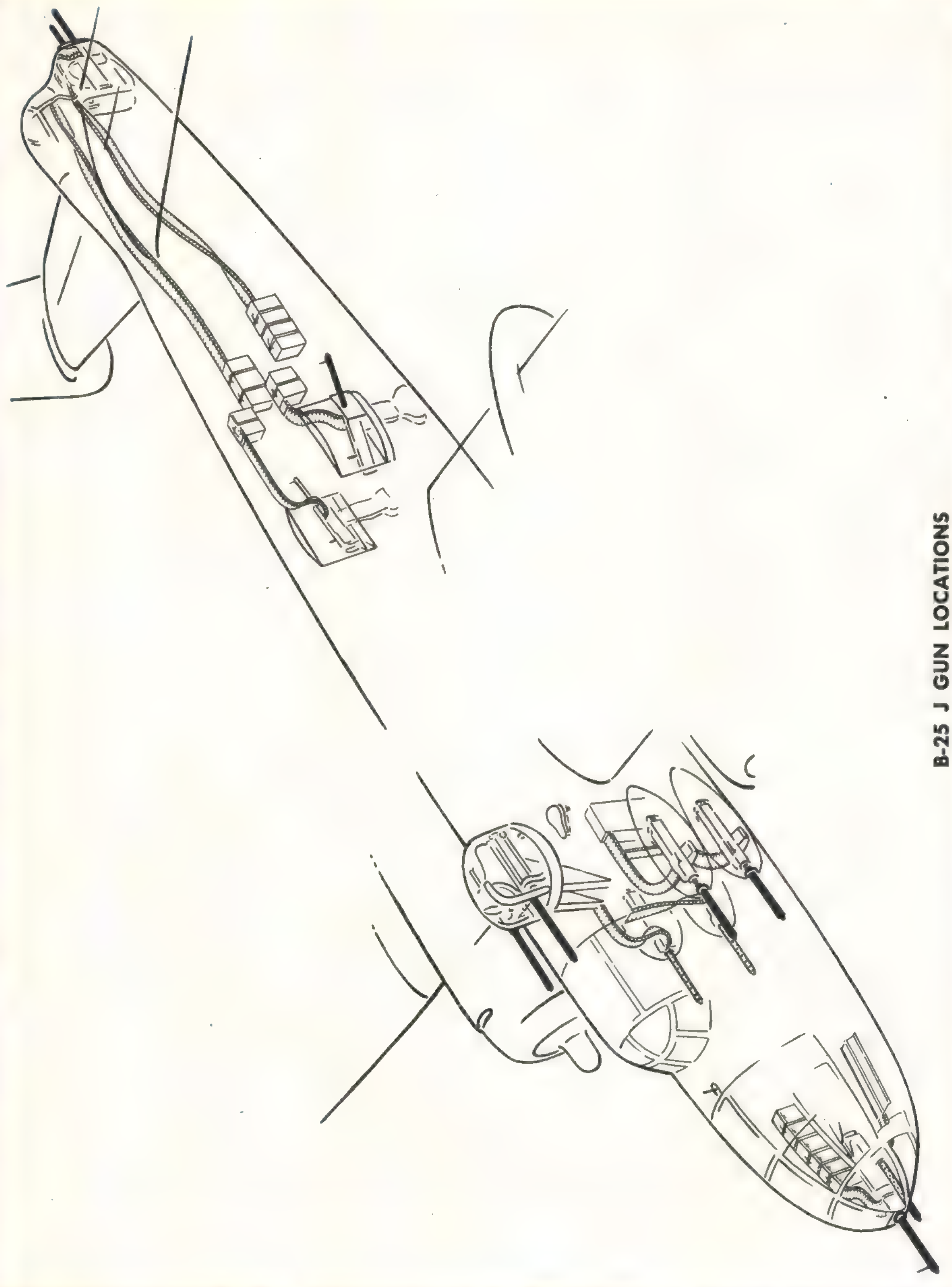
All guns on the B25-J are standard M-2 .50-cal. machine guns. Early planes had 1 fixed and 1 flexible forward firing gun. Late planes have 2 fixed and 1 flexible forward firing gun, and provisions are made to convert the flexible nose gun to a fixed gun.

Four fixed .50-cal. forward firing guns are mounted in blisters, two on each side of the fuselage. The fixed nose guns are charged manually by handles in the pilot's compartment. The blister guns are charged manually by handles in the forward end of the upper turret compartment.

A type N-3B or N-3C optical gunsight governs the firing of the forward-firing fixed guns. The pilot fires the fixed guns; the bombardier fires the flexible nose gun.



B-25 H CANNON AND NOSE GUNS



B-25 J GUN LOCATIONS

OXYGEN

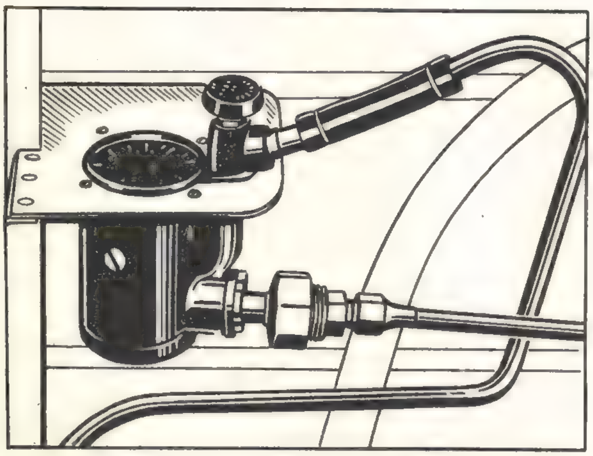
The B-25 has two systems of oxygen supply. The first is a permanent installation in the early-series aircraft, the second a portable system in later-series B-25's.

The permanent oxygen system is of the low-pressure type, operating at an average starting pressure of 400 lb. sq. in. There are three low-pressure oxygen cylinders in each nacelle, two at the front and one at the rear. The cylinders, held in place by padded metal straps, are removable.

One filler valve in each nacelle allows servicing of the system. A relief valve in the bomb bay relieves overload pressure on the oxygen system caused by overfilling of oxygen cylinders or thermal expansion.

The oxygen system has eight low-pressure regulators. A pressure gage in each regulator shows the pressure of the entire system. The valve, operated by turning a knob on the lower part of the regulator, adjusts the amount of oxygen flow. A dial on the face of the regulator indicates the oxygen flow in thousands of feet of altitude, thereby simplifying regulator adjustment.

An outlet tube extends outward from the bottom of each regulator, and the hose from the oxygen mask slips over this tube. The outlet tube of the upper turret operator's regulator is on the upper turret support column.



Oxygen Regulator

When oxygen is not being drawn from a regulator, be sure that the valve is completely closed to prevent leakage.

Type A-8B masks are used with this system and permit breathing through either the mouth or the nose. The small valve at the bottom of the re-breather bag is for draining off any water collecting in the bag. A low-pressure rubber tube connects the mask to the regulator. Use a weak solution of creosol to clean and sterilize the mask parts.

LATE AIRPLANES

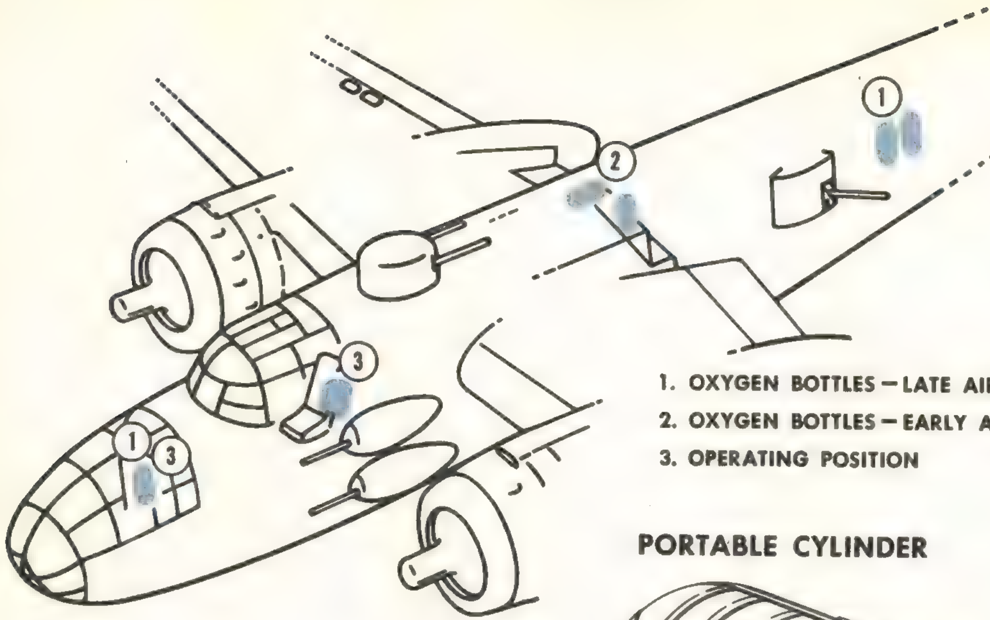
Late airplanes are equipped with portable oxygen units consisting of two or more low-pressure units.

In operating position, the units are supported in canvas sacks attached to the pilot's seat. One unit is mounted in the bombardier's compartment on late airplanes. Each unit, comprising cylinder, regulator, pressure gage, filler valve, and the necessary fittings, lines, and supports, is complete and independent. Each portable oxygen unit employs one F-1 type cylinder having a working pressure rating of 400 lb. sq. in. The regulator gages, lines, and fittings are on one end of the cylinder and the drain is in the port at the opposite end.

A demand-type regulator feeds oxygen to the mask. It automatically admits into the system the proper amount of air from the cabin, the quantity depending on the altitude, and releases the mixture as the user inhales.

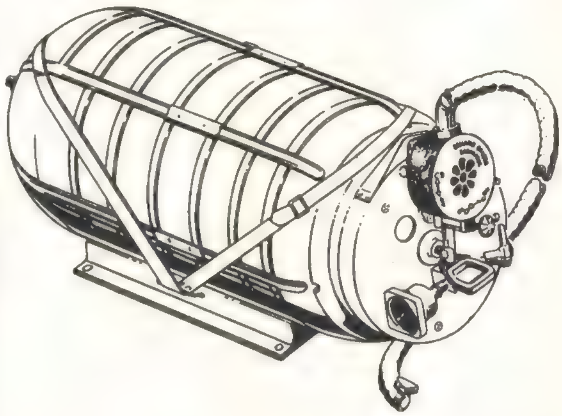
The tube assembly which conducts the mixture to the mask is clamped to the regulator elbow. Adjust the position of the elbow by loosening the nose coupling which attaches the elbow to the regulator, moving the elbow to the proper position, and tightening the nose coupling. It is important that the coupling and all other connections be tight at all times.

If the regulator fails, it may be bypassed by turning the red emergency knob in a counter-clockwise direction to "ON." A lever controls the automatic mixture feature of the regulator. When the auto-mix is turned "OFF," the regulator releases pure oxygen to the mask.



1. OXYGEN BOTTLES — LATE AIRPLANE
2. OXYGEN BOTTLES — EARLY AIRPLANES
3. OPERATING POSITION

PORTABLE CYLINDER



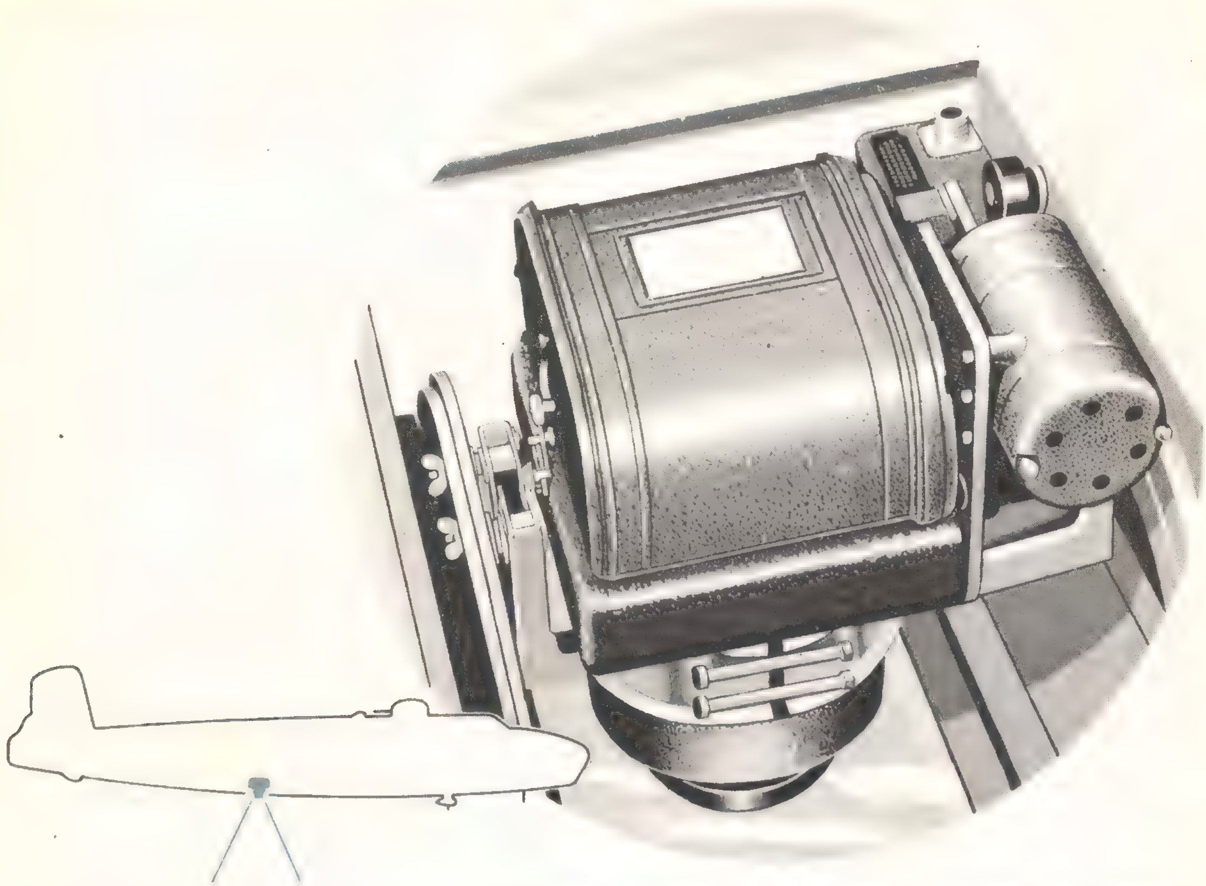
A-14 Demand Oxygen Mask

An A-10 revised or A-14 type mask may be used with the portable oxygen unit. Before any flight on which you expect to use oxygen, see that the mask is of the proper type and is the correct size and shape for your face.

KEEP ALL OXYGEN EQUIPMENT FREE FROM CONTACT WITH OIL OR GREASE.

FAILURE TO DO THIS MAY RESULT IN AN EXPLOSION.

PHOTOGRAPHIC EQUIPMENT

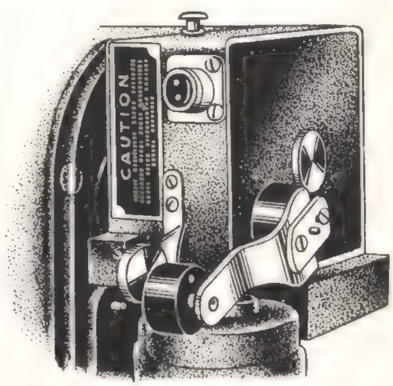


A mount for a type K-24 camera is located just behind the bomb bay in the fuselage floor. The camera mount allows the camera to swing 50° fore and aft of the vertical position.

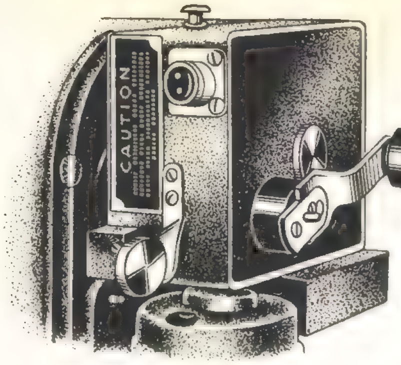
The K-24 camera does not require a vacuum pressure plate. An optically flat glass plate holds the film in the focal plane of the camera. When the film is moving the pressure on the plate is relaxed and the film moves freely. The camera takes a picture 5 inches square with types 1A, and 1B, in A, F, N, and K, emulsions of aerial roll film. This permits a number of exposures without reloading or other manual attention, 115 to 125 exposures can be made on one full length roll of film.

The camera is designed to be operated electrically, but can be operated manually by a winding handle on the right side of the camera.

Note: The winding handle must either be stowed or in the operating position before the camera is installed, because the mount prevents movement of the handle from one position to the other.



WINDING CRANK STOWED



WINDING CRANK UNSTOWED

Intervalometer

The intervalometer automatically establishes a pre-selected interval between exposures. A dial on the face allows you to select the time interval. A range of from 2 to 120 seconds, at 1 second increments, is available.

A jeweled warning light in the intervalometer flashes on 2 seconds before the camera starts to operate.

A "STOP" button will stop the camera at any time.

The Airplane Changes

Combat problems in several theaters of war found the A, B, C, and D models of the B-25 unsuited for certain tactical operations. A series of modifications were necessary to overcome these problems.

The B-25 was originally designed for medium-altitude bombing, but combat theaters found it maneuverable and fast, making it suitable for low-altitude bombing and strafing missions. Additional firepower, armor plating, and re-arrangement of equipment were necessary to equip the B-25 for this type mission.

The B-25G, basically a modified C or D, has a 75-mm. cannon and additional forward-firing .50-cal. guns. The B-25G carries no bombardier; therefore the pilot operates bombing mechanisms and all forward-firing guns. Later models of the B-25G have additional firepower. Waist guns and a tail stinger, with more armor plating for the crew, make the B-25G a 4-fisted menace to enemy shipping and ground installation.

The B-25H, which followed the B-25G, underwent several changes to make it an even more formidable weapon. With the 75-mm. cannon still part of the equipment, four .50-cal. forward-firing guns were installed in the nose, and four .50-cal. blister guns, two on each side of the fuselage, were added.

With no bombardier aboard, the pilot does all the bombing and fires all forward-firing guns. The upper turret has been moved from the rear of the plane to the navigator's compartment, giving it a more effective arc of fire. Two .50-cal. waist guns, one on each side of the fuselage just aft of the bomb bay, are operated by the radio gunner. A tail turret provides two more .50-cal. guns. The B-25H, primarily used for low-altitude attack, has fourteen .50-cal. machine guns and one 75-mm. cannon in addition to its complete bombardment equipment.

The B-25J is designed to operate as a medium altitude bomber and at the same time to provide sufficient firepower for low-altitude strafing missions. With no cannon aboard, the nose is reconverted into a bombardier's compartment with the addition of two forward-firing .50-cal. guns. One fixed .50-cal. gun and one flexible .50-cal. gun in the bombardier's compartment—plus the four forward-firing blister guns—give the pilot highly effective firepower. The rest of the firepower is identical with that of the B-25H. One excellent feature of the B-25J is the dual bombing controls, giving the pilot or the bombardier individual control of all bombing equipment. With twelve .50-cal. guns, it is one of the deadliest medium bombers in operation.

CHECKLISTS

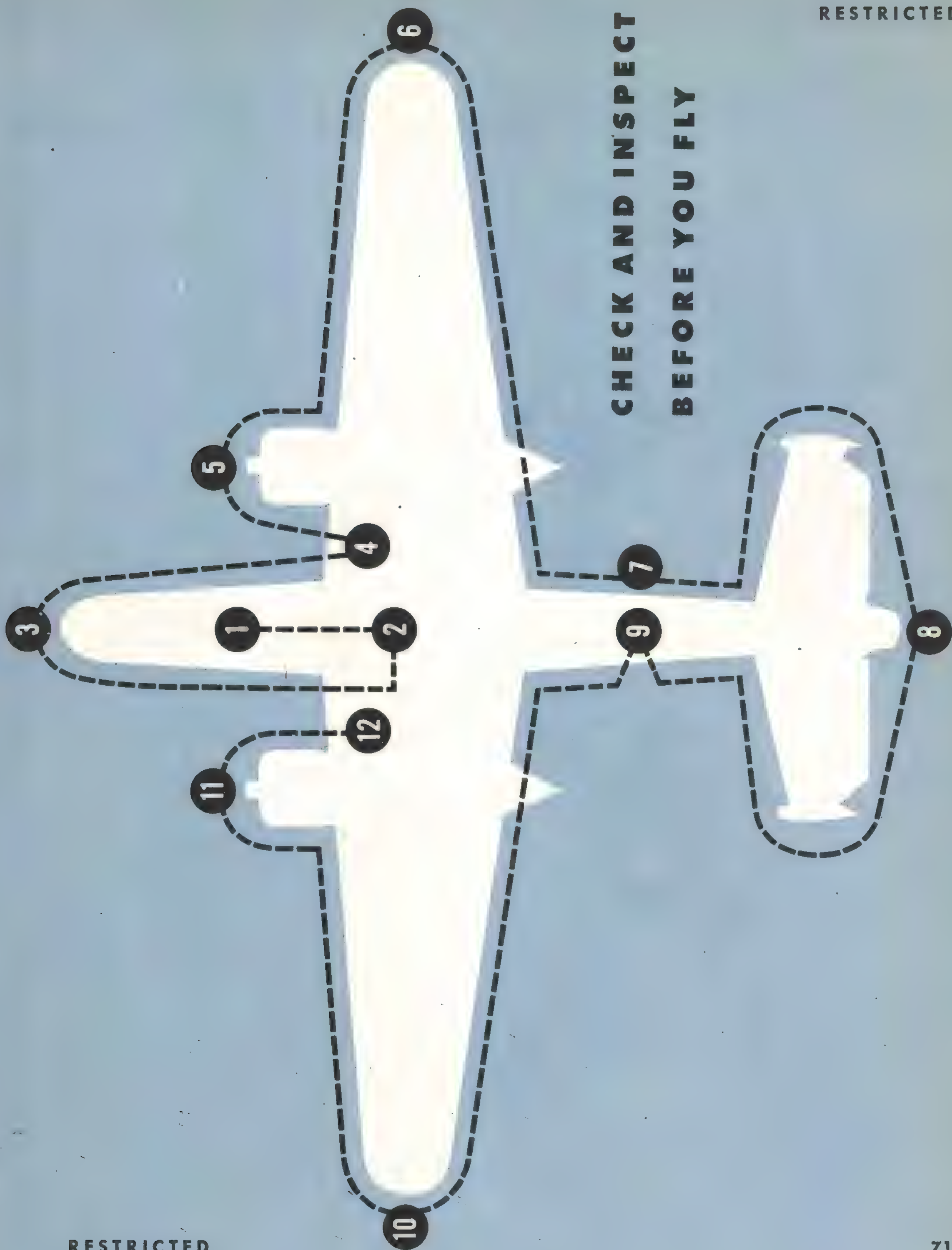
and how to use them

The checklist is a valuable part of your airplane. It is as much a part of your plane as the radio equipment, the guns, or even the flight controls. Use it properly and you are well on the road to safe flying. It is the best way to avoid the largest single cause of airplane accidents—pilot error.

There are too many controls to be set properly, and too many instruments and indicators to be checked, to allow for any but the most definite procedures. It won't take a lot of your time—get the standard AAF checklist from the cockpit and follow this simple diagram.

1. PRE-INSPECTION CHECK (Pilot's Cockpit)
2. BOMB BAY
3. NOSE SECTION
4. RIGHT LANDING GEAR
5. RIGHT ENGINE
6. RIGHT WING
7. RIGHT FUSELAGE
8. TAIL SECTION
9. REAR COMPARTMENT—LEFT FUSELAGE
10. LEFT WING
11. LEFT ENGINE
12. LEFT LANDING GEAR

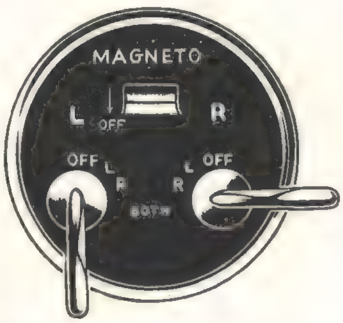
CHECK AND INSPECT BEFORE YOU FLY



Starting Engines

USE THE CHECKLIST FOR STARTING

Fire guard posted.
Props clear.



Ignition switches "ON," one at a time

Booster pumps "ON"—operate only the switch on the engine you are starting.

Energize 10 seconds when using an external power source, 20 seconds when using the plane's batteries.

Prime—Use primer for 2 seconds while energizing. This is not a priming action; it merely fills the primer lines with fluid and allows instant priming when the engine is engaged.

Engage—Hold down energizer, primer and engaging switch until the engine starts. Mesh for reasonable time. If engine does not fire, repeat starting procedure.

Move mixture control to "FULL RICH" when engine starts.

Check oil pressure—(40 lb. in 30 seconds).

If the oil pressure does not reach 40 lb. in 30 seconds stop the engine and investigate.

Repeat procedure on the left engine.

Booster pumps "OFF"—check fuel pressure. There must be 6-7 lb. sq. in.

Warm up at approximately 1200 rpm.

Battery-disconnect switches **"ON"** (if external power is used).

Hydraulic pressure—(800-1100 lb. sq. in.).

Brake pressure—(1000-1200 lb. sq. in.).

Suction—(3.75-4.25" Hg.).

Radio "ON."

If the engine backfires and excess fuel in the intake section catches fire, move the mixture control to "IDLE CUT-OFF" and advance the throttles to full open.

Keep the engine turning over with the starter if the fire is small. Keep the throttles open wide and the mixture in "IDLE CUT-OFF" until the fire burns out.

If the fire continues to burn, flaring out of the air scoop and the cowl flaps, **turn the engine fuel cut-off valve "OFF" and use the**

hand extinguisher (CO_2) on the base of the flame. Always keep the throttles open wide to exhaust all the fuel that can reach the engine.

If this fails, use the Lux system if it is installed in the airplane. When you encounter fires of this type and have used the Lux system, **do not attempt to restart the engine.** If in attempting to restart the engine you start another fire, you will have no positive means of extinguishing the flames.

Don't try to rush the warming of the engines during the warm-up period. The R-2600 engines have a great mass of metal in them, and the warm-up must be thorough. Some parts of the engines will warm up while other parts are still cold.

Many engines have been ruined by improper warm-up.

Watch cylinder-head temperatures closely during warm-up, as the engine temperature rises more quickly in operation at idling settings on the ground than at high power settings in the air.

There are pressure baffles on this plane, and very little air can flow around the cylinder heads when the plane has no forward speed.

Caution

Use auxiliary power from a battery cart for starting whenever possible. Prolonged starting attempts drain the batteries very quickly, especially in cold weather.

Keep the invertors OFF until one engine is running if no auxiliary power is available.

RUN-UP

1. Advance the throttles to 1600 rpm.
2. Pull back the prop controls until a 350-400 rpm drop is indicated. (Manipulating the prop controls circulates warm oil through the prop dome and gives smoother governing action.)
3. Check the feathering system before your first takeoff.

Run the left engine to 1700 rpm and set the right engine at 1400 rpm. Push the right feathering switch DOWN and check for a drop in rpm. Pull out the feathering button when you observe a 100-150 rpm drop. Reverse the power settings and repeat the procedure on the left engine.

NOTE

Check the ammeter for a charge as you make these feathering checks. The electrically operated feathering system drains the batteries if the generators are not charging.

4. At 1600 rpm, check generators' output: voltage at 28 to 28.5, amperes 20 to 60.
5. Advance the throttles on the engines until the rpm is set at 2000. Maximum manifold pressure not over 28.5" Hg. Check the right and left mags. For a thorough check, the time on one mag is 2 to 3 seconds. Between checks on "L" and "R" settings return the switch to "BOTH" and allow the engine to regain speed. A loss of 75 to 100 rpm does not necessarily mean that the plane is unsafe for flight. If the engine does not vibrate excessively during the check, and if it will put out rated power, a drop of 75 to 100 rpm is considered safe for takeoff. However, be on the lookout for a drop in rpm. If the drop is sudden, or if backfiring occurs, do not fly the plane until it has been re-checked. A drop of 100 rpm is the maximum permissible for takeoff.

Following the mag check, run the engines up to 30" Hg. At this manifold pressure you will get an approximate reading of 2400 rpm, which means that the plane should give you sufficient power for takeoff.

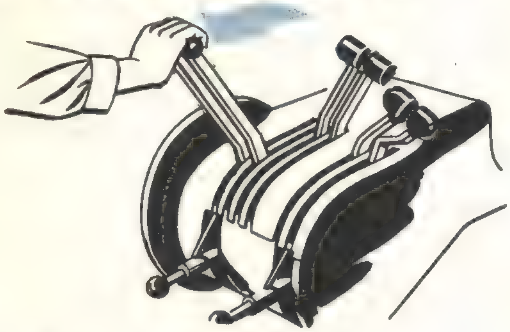
Check the supercharger before a high altitude flight. (See operating the supercharger.)

POWER CHANGES

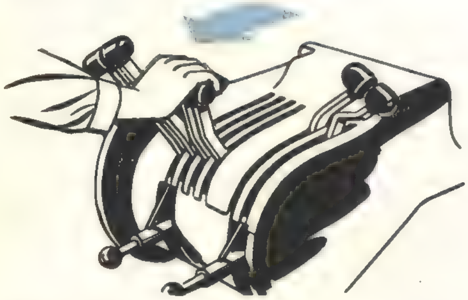
Always make power changes smoothly and evenly. This engine will not absorb a sudden blast of power without acting up.

Move the controls slowly and smoothly to the desired settings rather than attempting to **make one swift** movement and pick up the proper settings.

TO REDUCE POWER



1. Reduce manifold pressure

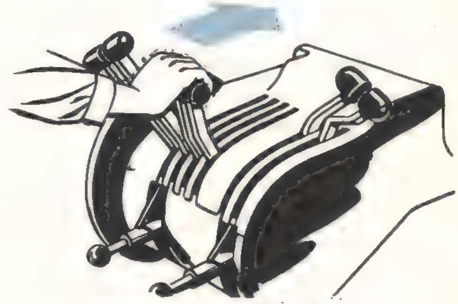


2. Reduce rpm

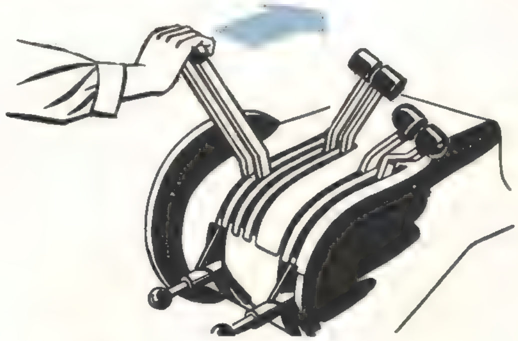
If the rpm is reduced first, you get a jump in manifold pressures. This causes detonation if the relation of the rpm to manifold pressure is altered greatly.

An engine running at constant power settings uses a constant amount of fuel and air. If the rpm is reduced, this fuel-air supply remains almost constant, and an engine running at reduced speed cannot absorb this fuel-air charge. Pressures in the impeller and cylinder heads rise as a result and cause detonation.

TO INCREASE POWER



1. Increase rpm



2. Advance throttles

As engines pick up speed the manifold pressures drop; this is a normal and desired reaction. Adjust the throttles and synchronize the engines.

Remember

MAKE POWER CHANGES SMOOTHLY AND EVENLY

TAXIING

Taxiing the B-25, with its tricycle landing gear, may seem strange after handling the conventional type.

The primary controls for taxiing are the throttles, rudders, and the brakes when necessary.

Proper coordination of these controls gives you effortless taxiing.

Carburetors should be adjusted to idle at 600-700 rpm. The scavenger pumps lose their prime and the plugs foul at a lower rpm.

Operate the throttles as smoothly as possible, and when you stop the plane for any reason set the rpm at 1000. This prevents fouling and creates enough propeller blast to help cool the engines.

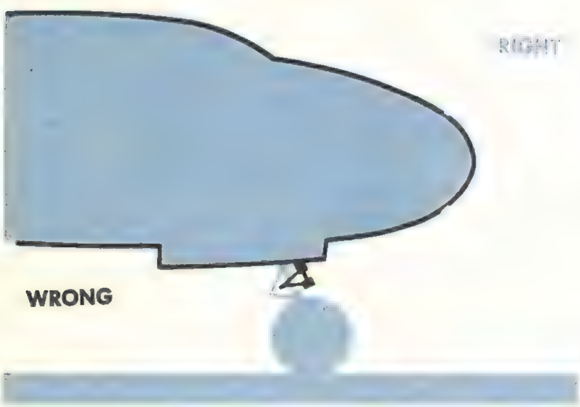
UNLOCK THE PARKING BRAKE AND ALLOW THE PLANE TO ROLL STRAIGHT AHEAD

DIRECTION OF ROLL

Don't try to guide the plane for the first few feet of its roll. If you do a great side load is exerted on the nosewheel strut if the nosewheel is not pointing in the direction you are trying to guide the plane. Never use force; you will shear or snap the nosewheel strut under the pressures applied by the brakes and engines.

This airplane has conventional-type toe brakes on the rudder pedal. After the airplane is moving, apply the brakes evenly and firmly to check for adequate braking action. **Never allow the taxi speed to build up without making a brake check.**

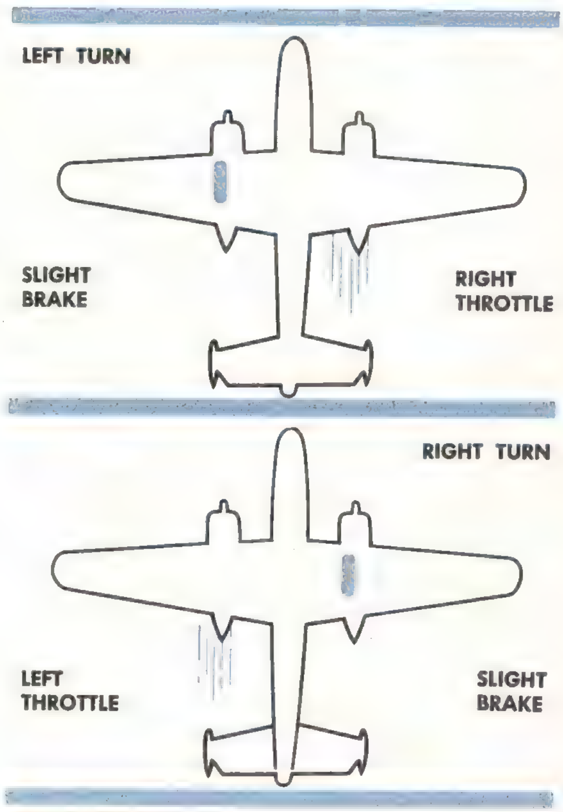
When the direction of roll is established, make corrections by coordinating the rudder and the throttle and using the brakes only when necessary. Use the brakes lightly, working to achieve accurate control with minimum pressure.

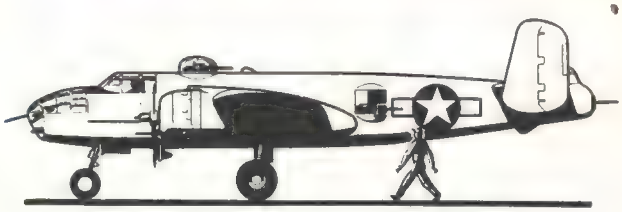


You will never need hard, rough braking action if you use the brakes properly.

Use the throttles to aid in taxiing, always keeping in mind that you must anticipate the reaction of the thrust. Lead the turn. Lead the corrective action needed to stop the turn.

Do not use excessive power. When one throttle is advanced, retard the opposite throttle. Don't let power accumulate by jockeying first one throttle and then the other.





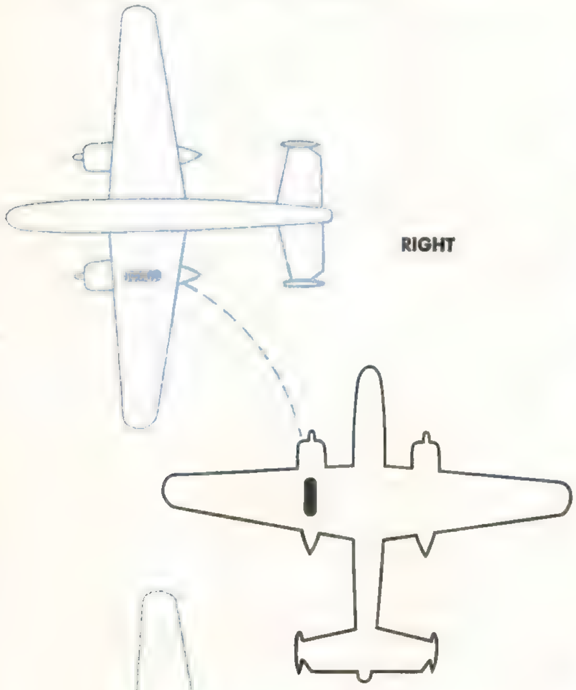
IN THE VICINITY OF OTHER PLANES AND EQUIPMENT, KEEP THE SPEED DOWN TO THAT OF A WALKING MAN.

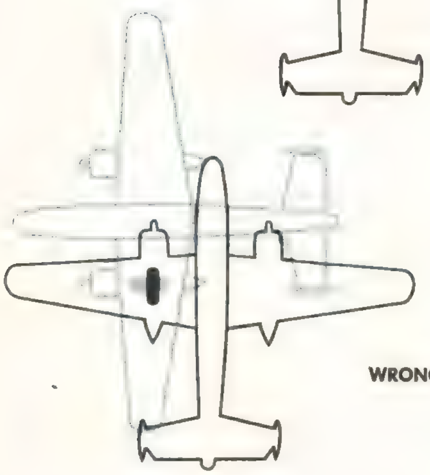
On straight-away taxiing let the plane roll free and maintain directional control with the rudders. The twin tail assembly of the B-25 gives ample rudder control even at relatively low taxiing speeds, although even when full rudder is applied there is a slight delayed-action effect.

Never ride the brakes; this causes them to heat up rapidly.

Apply the brakes by feel, not by the position of the pedals.

Never allow the inside wheel to stop during a turn. To turn sharply, slow the airplane to a low speed and coordinate the brake and throttle to keep the inside wheel turning on an approximate 10-foot radius.





Any attempt to twist the plane on the inside wheel damages the wheel, tire, and strut. Turning in this manner on soft ground, sand, or thin paved runways causes the wheel to dig into the runway, sometimes rupturing the runway surface.

This turning action may twist the wheel and strut off the airplane. What is worse, the damage may not be apparent but the gear may be damaged so badly that it will fold up under the strain of a landing.

Park a safe distance off the end of the runway you intend to use for the takeoff. Turn into the wind to provide maximum cooling for the engine run-up. The engine installations cool efficiently only when the airplane is in flight. Sufficient air for cooling is never available during ground operation. Take advantage of every opportunity to aid the engines in cooling.

Nosewheel Position Indicator

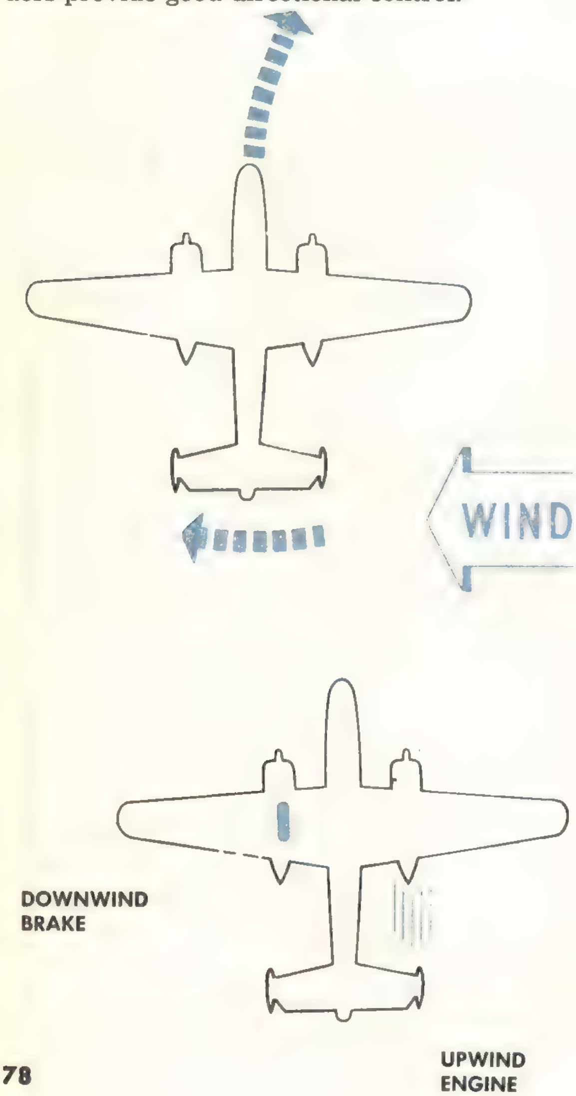
A nosewheel position indicator is on the lower center section of the pilot's instrument panel. It warns you of the position of the nosewheel by flashing on one of two lights when the nosewheel turns past 15° in either direction.

You can adjust the brilliancy of these lights by turning the jeweled cap to "DAY" or "NIGHT." Check this indicator constantly when taxiing under abnormal conditions and when recovering from sharp turns.

Crosswind Taxiing

The windvane effect so noticeable in lighter airplanes will still be with you in the B-25, but not to the same extent. The airplane tends to turn into the wind.

Use the upwind engine, the downwind rudder, and the downwind brake to prevent this streamlining. Advance the upwind throttle and let the downwind rudder streamline itself downwind. Keep enough pressure on the rudder pedal to prevent the rudder from banging against the stops. This gives you good control in all but the most violent crosswinds. Use a small amount of downwind brake when necessary. Don't let this become a habit, however, as in all ordinary conditions the throttles and rudders provide good directional control.



Taxiing in Mud or Sand

The only new element added to taxiing by the presence of mud or sand on an airfield is the greater resistance to the passage of the nosewheel. This resistance tries to force the nosewheel from its normal trailing action to a reversed position.

Because of this new factor observe these additional precautions:

1. **Once the airplane is moving, keep it moving.**
2. **Avoid sharp turns unless absolutely necessary.**
3. **Avoid using the brakes unless absolutely necessary.**
4. **Hold the elevator control full back to lighten the load on the nosewheel.**

Use this procedure in mud or sand:

When the airplane straightens out of a turn the nosewheel loses the tendency to trail properly as the depth of the tire sink increases.

When abnormal power must be used to move the airplane, the tire sink is too great. One of the crew must walk ahead of the plane and warn you when the nosewheel attempts to reverse its direction.

If the airplane is allowed to pivot on one wheel the nosewheel assumes a short angle toward the rear and the pivot wheel mires itself. To correct this:

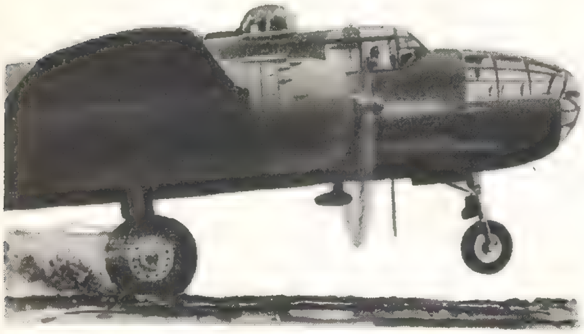
1. Cut the engines
2. Remove the towing lockpin
3. Insert the tow bar or a piece of iron pipe and manually turn the nosewheel in line with the airplane fuselage.

If either of the main wheels is deeply mired, dig a shallow trench, with a slight upslope, in front of the wheel. Check to see that the nosewheel is lined up in the direction of roll.

Start the engines and run them up with brakes set. Lower the flaps, pull back on the wheel, and release the brakes.

Caution—If the wheels are mired too deeply the propeller tips will strike the ground. When there is danger of this, the airplane must be moved by a tractor.

GET THE NOSEWHEEL UP QUICK ON TAKEOFF IN MUD OR SAND



Don't try to move the airplane over soft ground with the nosewheel towbar alone. This will break the nosewheel strut and pull it from under the nose of the plane. Attach chains to the main wheel struts for towing. Guide the nosewheel with the tow bar.

To take off from mud, sand, or a rough field, raise the nosewheel quickly to relieve the weight during the run.

Land normally on mud or sand. Make every effort to hold the airplane straight without using the brakes. This prevents skidding on a slick surface. Great side loads are applied to the gear in skids of this type and must be avoided.

Common Taxiing Errors

Riding the brakes. Depress the toe pedals only when necessary.

Rough braking action. Avoid this by anticipating the need for brakes.

Rough or no use of the throttles.

Improper use of the rudders. There is a common tendency to forget that there are rudders. When the runway and taxi strip are clear, let the plane roll free and control with rudders.

Failure to clear the area. This is the cause of most taxi accidents. There is no excuse for taxi accidents.

Fast taxiing in congested areas.

Turning with the inside wheel not moving.

TAXIING TIPS

Never pivot on the inside wheel during a turn.

Never turn sharply at high speeds.

Do not use more power than necessary when taxiing.

Be extremely careful when taxiing on a strange airfield.

In the immediate vicinity of other planes, never taxi faster than is necessary to maintain control. Always proceed under guidance from the ground.

Hold the elevator control in neutral or back position at high power settings to relieve the load on the nosewheel.

Hold firm control pressures when you taxi behind parked airplanes that are running up their engines. The blast from their prop wash may damage your flight controls by banging them against the stops.

Do not turn sharply into the parking area. Come up behind the parking position and move the airplane ahead slowly.

Never cut the engines with the idea of rolling to a stop. Lack of hydraulic pressure may cause brake failure.

Do not run up engines if light planes are behind you.

PARKING

When you park your plane after a flight, just remember that the Colonel may make the next flight in that particular airplane.

As you approach the parking ramp stay alert and plan your taxiing so that you can pull into position straight ahead.

Never make a sharp turn into the parking position. This leaves the nosewheel angled across the direction of roll you use in leaving. Furthermore, a buddy may snuggle up on each side of you, locking you in position just as securely as if they used a chain.

The nosewheel position indicator warns you when the nosewheel is more than 15° from straight ahead. Release the brakes and allow the plane to roll forward. Correct the alignment of the nosewheel, re-park, and set the parking brakes. Use the checklist to stop the engines.

Caution

Don't allow anyone to leave the airplane until the engines are stopped and the ignition switches are OFF.

PARKING COMPLETE–
NOSEWHEEL PROPERLY LINED UP

TAKEOFF

Takeoff in the B-25, with its tricycle gear, varies from that with conventional gear only during the initial part of the roll. You will find it much easier. The principal difference is in attaining the proper angle of attack of the wing. On the conventional type you start from a stall attitude and reduce the angle to permit flight. In the B-25 you start from a negative angle of attack and increase the angle of attack by raising the nosewheel.

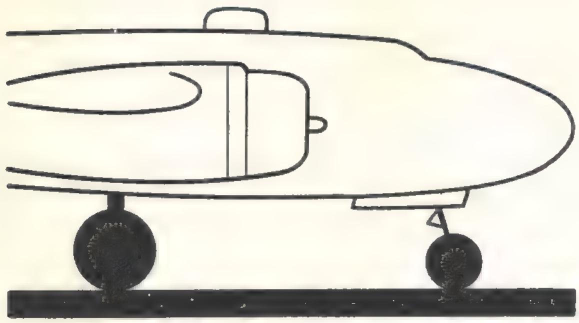
Several factors affect the takeoff technique. Chief of these are gross weight, wind velocity, type of runway, and the height and distance of the nearest obstacles. Plan your takeoff according to these variables. The following takeoff is normal.

When you get permission to take off, taxi out and line up properly. Advance the throttles slowly, using them to obtain directional control. As soon as the plane is rolling straight, equalize the throttles and advance them smoothly to takeoff power. **Check the engine instruments for maximum power indications and for irregular operation—if in doubt cut off the power.** Don't load up the engines with a sudden blast of power. You are operating powerful engines; treat them with care and respect.

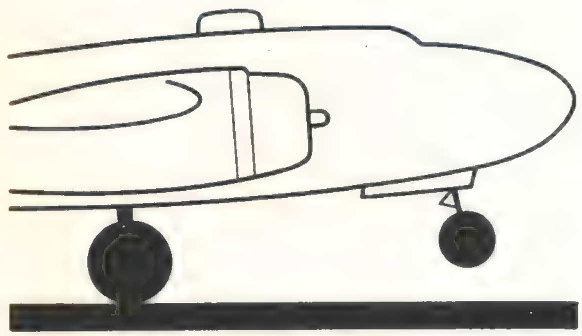
Be prepared to make power adjustments during the takeoff. If an engine fails before you gain safe single engine speed, you must reduce power quickly to prevent loss of control.

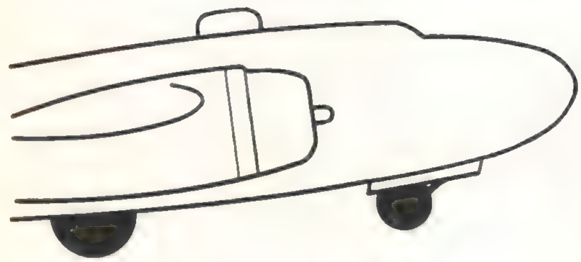
After you start the takeoff run, use the

START TAKEOFF RUN WITH 20° FLAPS



RAISE NOSEWHEEL OFF GROUND





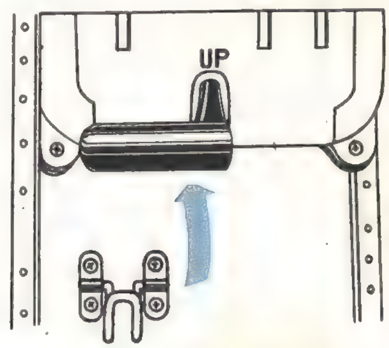
RAISE THE GEAR AS SOON AS PLANE IS DEFINITELY AIRBORNE

brakes only in an emergency. Maintain directional control with the throttles and rudders.

Raise the nosewheel off the ground slightly as soon as you have good control. The angle of attack and the weight of the B-25 tend to keep the plane on the ground during the takeoff roll. The takeoff becomes conventional when a positive angle of attack, with resulting lift, is developed.

The B-25 flies itself off the ground. Allow it to do so, for smoother, easily controlled takeoffs. If the plane attempts to skip and bounce in slight crosswinds, help it lift off the runway, thus smoothing out the takeoff.

When the airplane is definitely airborne, raise the wheels. **Be sure there is no possibility of further contact with the ground.** Good airplanes have been lost through carelessness.



1. Lift the safety lock holding the control handle "DOWN" and locked.
2. Move the mechanical lock up.
3. Move the landing gear handle to "UP."

Level off and allow the plane to gain SSE flying speed (145 mph).

Reduce power to maximum climbing power settings. Don't base this power reduction on distance from the field. The particular situation, load, speed, terrain features, and altitude determine the proper place for this reduction.

Reduce power as soon as possible, however, to relieve the strain on the engines. Let the plane climb slowly, gaining speed as it climbs. Reduce the power to normal climb settings as soon as you establish a constant climb. Load conditions cause the climb settings to vary slightly.

Maintain a climbing speed between 160 and 170 mph for these reasons:

1. Speed is developed quickly and maintained to allow single engine operation if necessary.
2. Excessively slow climbs prevent proper cooling of the engines at high power settings.
3. You obtain good forward visibility by keeping the nose relatively low.

Raise the wing flaps when you have sufficient altitude. This will normally be about 300 feet above the terrain and between 150 mph and 170 mph. Apply back pressure to the control column as the flaps come up, increasing the angle of attack of the wings. This defeats any tendency to settle and lose altitude.

Close cowl flaps as soon as possible after takeoff, but leave them open if the cylinder-head temperature approaches 200°C.

NOTES ON TAKEOFF

Do not dive the airplane after lifting it at the end of the takeoff run. When you level out to pick up SSE speed after takeoff release the stick pressure as the speed picks up.

Gain safe single engine speed immediately after takeoff. This is the slowest speed at which the rudder has a safe margin of control over the unbalanced thrust of the live engine at full power. In the B-25, **it is 145 mph.**

Avoid the head-in-cockpit habit. Look around constantly and check the instruments quickly.

Common Takeoff Errors

Failure to keep the airplane straight ahead. Unfamiliarity with the airplane and uneven power application cause this. **Remember,** there are 2 large rudders. It takes considerable foot pressure to control them on takeoff.

Jockeying or blasting the throttles to maintain directional control

Using brakes to steer the plane

Excessive manifold pressure

Head in the cockpit

Excessive airspeed on the ground

Retracting landing gear too soon

Failure to level off after takeoff

Failure to correct properly for drift

Skidding immediately after takeoff

Tenseness and overcontrolling

Don't brake the wheels after takeoff. Your brakes cool better if you let the wheels spin.

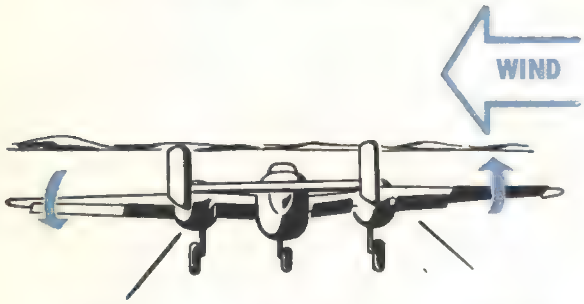
CROSSWIND TAKEOFF

Modern flying, with its heavy airplanes, demands a runway for safe operation. The days when you taxied out, lined up parallel to the wind tee, and took off are gone forever. Instead of 360° of airfield available for takeoff, the modern airfield has three runways, usually set to take advantage of the six cardinal points of the prevailing winds. Using these runways, you encounter crosswinds of varying degrees and intensities.

The aids to a crosswind takeoff are the rudders, the throttles, the aileron, and, as a last resort, the brakes.

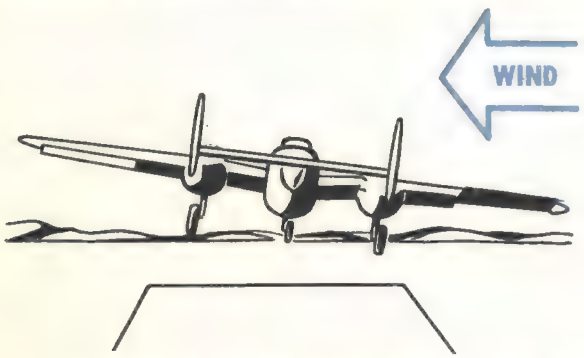
The technique is:

1. Make the usual takeoff checks.



2. Advance the throttles, leading with the upwind throttle. The strength of the wind will determine the amount of lead.

3. As the speed increases and the rudders become effective, equalize the throttles.



4. Leave the ground with the throttles evenly set and use just enough rudder and aileron to make a coordinated turn into the wind, thus counteracting any drift.

The plane may skip as the speed increases toward the end of the takeoff roll. This is an indication that it is ready to fly. Help it along to prevent skipping and to keep the consequent side thrust from injuring the landing gear.

DON'T JUGGLE THE THROTTLES

Common Errors

1. Failure to recognize the drift.
2. Trying to correct the drift by skidding instead of turning into the wind. This increases the stalling speed and if violent enough it will put the plane back on the ground. The bounce will be made with the drift applying a side thrust to the gear.
3. Juggling the throttles, giving uneven control. Lead the upwind throttle, constantly reducing the lead. As the speed increases the rudder control is great enough to take off cleanly.

TRIMMING

When properly trimmed the B-25 flies with an ease that belies its weight and size. Watch an old instructor pilot at the controls and you will see that he practically flies the plane with the trim tabs.

Learning to trim a plane properly and to detect quickly when it is out of trim boosts your ability as a pilot.

Every change of attitude, airspeed, and power settings, causes a corresponding change in pressures on the controls. If the trim tabs are not adjusted for the varying pressures, the resulting physical strain tires the strongest man in a surprisingly short time.

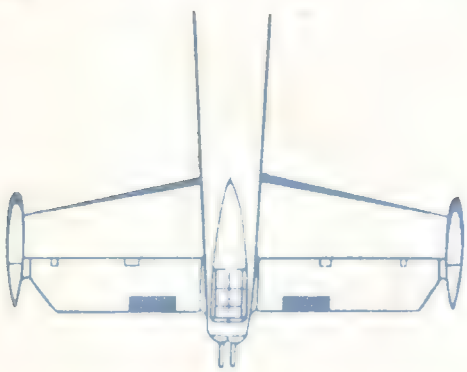
Always Keep the B-25 in Trim

To execute any maneuver properly, you must keep the airplane in trim. Exercise particular care in setting the trim tabs on takeoff.

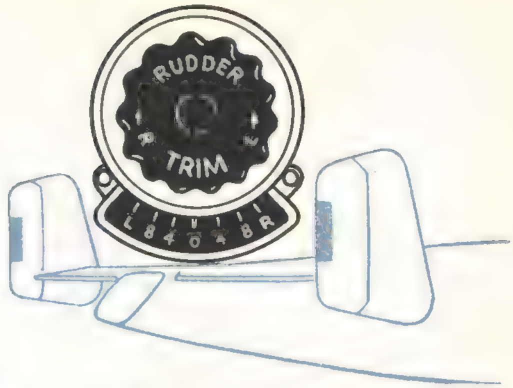
Improperly set tabs make control difficult as the speed and lift increase during the takeoff run.

To Trim the Airplane Properly

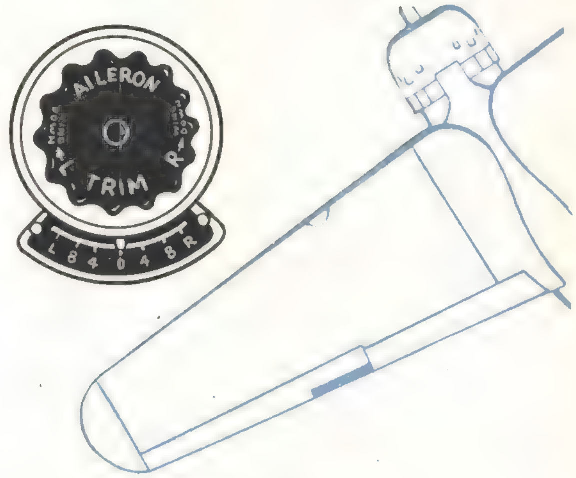
1. Keep the wings level by visual reference or by instruments. Hold constant airspeed and altitude.



2. Relieve all elevator pressure.



3. Relieve all rudder pressure.



4. Relieve all aileron pressure.

5. Make final adjustments on the trim tabs to obtain a hands-off flight condition with the ball centered on the turn and bank indicator.

Some planes are difficult to trim properly. This is a result of improper rigging and you cannot correct it while in the air. If you encounter this difficulty, check the trim and the weight and balance of the plane to see that it is properly loaded. After assuring yourself that it is the plane and not the pilot, report this condition on the Form 1A.

The engineering officer will run a check flight on the plane. His findings may result in the re-rigging of the plane and subsequent improvement in its flying characteristics.

How do you climb the B-25? Simple, you say —just pull her nose up. That is a definite part of the procedure, but unless a little more thought and a little less muscle accompanies the pulling you will ruin a good airplane.

The minimum safe climbing speed for proper cooling is 155 mph. Climbing at lower speeds overheats the engines.

Establish a normal climb at 160 to 170 mph using correct power settings. Trim the plane for hands-off flight. This allows you to concentrate on your surroundings. Turn as you climb so that you can spot approaching air traffic.

Turn the booster pumps "OFF" above 1000 feet. Level off at the desired altitude, maintain climbing power until the desired cruising speed is attained, then adjust power and trim. Move the mixture control to "CRUISING LEAN" if long-range cruise settings are used.

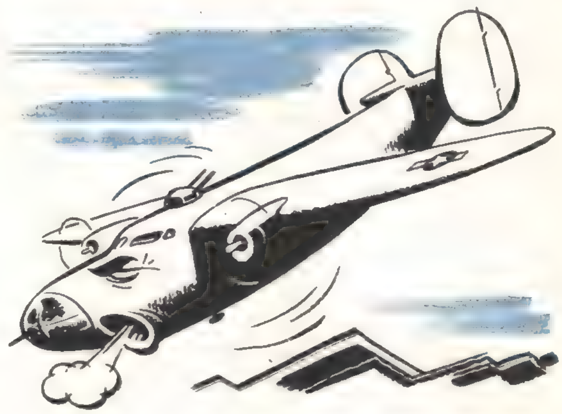
LET-DOWN

A let-down is a simple procedure either in instrument or contact flight.

Reduce manifold pressure slightly. Trim for hands-off flight and allow the plane to descend at a steady rate.

Adjust the throttles to avoid using excess manifold pressure during the descent. Never allow the engines to cool off rapidly in the let-down; if you do the engines will not run properly when power is applied because they will have become too cold. Lower the wheels, lower partial flaps and increase the power settings to prevent rapid cooling.

Level off at the desired altitude and adjust power and trim.



KEEP ENGINE WARM

IF IT COOLS OFF IT MAY COUGH

AT THE WRONG TIME

ADVANCED AIR WORK

Many of the maneuvers described here are prohibited in this airplane. However, knowing the reactions of the airplane to these maneuvers is important. Do not take these instructions as a license to abuse your airplane. It is better to stay away from trouble than invite it.

THE PROHIBITED MANEUVERS IN THIS AIRPLANE ARE:

LOOPS • SPINS • ROLLS • VERTICAL DIVES
IMMELMANNS • INVERTED FLIGHT • VERTICAL BANKS

These maneuvers are not prohibited because of the flying characteristics of the airplane, but because they impose severe structural stresses on it. The B-25 is a bomber, not a pursuit plane. Those pilots who try to make a pursuit plane out of a bomber succeed only in making a wreck of the bomber.

The maximum safe wingloading on the B-25 when pulling out of a dive is 3.67 G's, and then only at normal weight loadings or below. The designed gross weight of the plane is 26,620 lb. The maximum possible overload is 35,500 lb. Remember, however, that in present-day military operations you seldom fly a mission under normal load conditions. Almost all bombardment missions are overload flights.

The maximum diving speed of the B-25 is 340 mph with normal load weights. When the weight is 35,500 lb. the maximum speed is only 281 mph.

Know your airplane. The total flying time on the plane you are flying may have reduced the safety factor the manufacturer built into it. Some small trouble not found on the periodic inspections may show up in violent maneuvers.

The pilot who flew the plane the previous day may have abused the airplane, so conquer that urge to show off.

SPINS

SPINNING IS PROHIBITED IN THE B-25. If you do accidently get into a spin don't try to use either engine to recover. Follow this procedure:

1. Cut the power on both engines.
2. Get the nose almost straight down.
3. Raise the wheels and flaps if they are down.
4. Apply opposite rudder to stop the turn, as sufficient speed is developed.
5. Pull the plane out of the dive slowly when the turn is stopped. The B-25 is clean aerodynamically and picks up speed quickly. Avoid excess strain and possible structural damage.

You need a great deal of strength to make positive rudder and elevator control actions. The control column may come full back into your lap, in extremely violent spins or stalls. You and your copilot may have to use your combined strength to effect a recovery.

The best advice possible is—stay out of spins. If you do get into a spin and there is doubt that you can recover safely, don't stay with the airplane too long. It is bad enough to lose the airplane—**don't ride it down.**

If you are still out of control when you reach 5000 feet—Get out!

DIVES

The diving characteristics of the B-25, like all its flight characteristics, are exceptionally good. The first thing for you to remember, as a new pilot in the B-25, is this: the plane is not a dive bomber.

It was designed and built to carry a load of bombs to a target and return to its base. The fact that the plane can exceed these minimum requirements is no excuse to abuse it.

The red-lined diving speed on the B-25 is 340 mph. This maximum speed is possible only under definite weight limits.

Recover from a dive gradually. The structural load on the airplane increases in direct relation to the abruptness of the pullout.

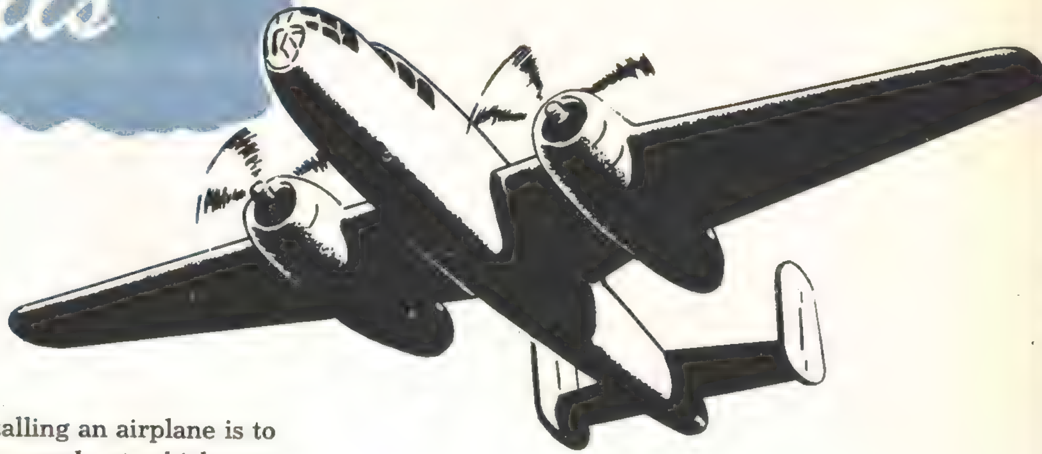
Be careful if you dive the plane in rough air, because the roughness increases the load and shock forces the plane must carry.

Combat requirements may force you to dive the plane when the gross weight is excessive. The plane will carry you through some tight spots in an emergency, but treat it gently. Don't place unnecessary loads on the plane by rough and careless handling.

MAXIMUM DIVING SPEED

Gross Weight Lbs. ➧		Normal Up to 26,620	Overload 28,000	30,000	32,000	34,000	35,000
Maximum allowable pull-out and push-over acceleration "g"		+3.67 −2.00	+2.67 −1.67	+2.67 −1.67	+2.67 −1.67	+2.67 −1.67	+2.67 −1.67
Maximum allowable diving speed (indicated)	MPH	340	340	340	332	303	281
Maximum permissible landing load factor		3.33	2.67	2.67	2.67		

Stalls



The main reason for stalling an airplane is to determine the **minimum speeds** at which you can maintain **fully controlled flight.** This includes flight with power-off, power-on, different flap settings, gear and flaps extended and retracted, flight in turns, etc.

Stalls are among the basic maneuvers of transition air work. When you learn to fly a new airplane you must find out any unusual stalling characteristics it may have. It may tend to fall off on one wing, or to drop the nose rapidly. You can't land an airplane properly and safely if you don't know these things.

The B-25 usually stalls from the wing root to the wing tip. It has no unstable tendency except for a slight lateral rolling. This is easily corrected by coordinated control pressure.

Changes of the CG position in the plane greatly affect the stall characteristics. **Do not stall the plane when the center of gravity approaches the fore and aft limits.**

Stalls and stalling speeds are directly related to many maneuvers which you will perform later. To know your plane's limitations, you must know its stalling speeds and characteristics. Remember—all the maximum performance maneuvers, and slow flying, are based on the effect of power on **stalling speeds of the airplane.** You must know stalls thoroughly before you can go on to advanced work.

Technique

Practice stalls at a safe altitude. Clear the area carefully and as often as necessary. Keep the prop controls set at climbing rpm.

Reduce the manifold pressure to 15" Hg., when practicing power-on stalls. This avoids exaggerated attitudes and violent stall characteristics. A pronounced buffeting warns you of an approaching power-on stall. This warning is absent in power-off stalls.

Even minor variations of power settings change the actual and indicated airspeeds. Keep the power settings consistent. Bring the airplane up slowly and smoothly to a tail-low attitude. Maintain constant back pressure on the control column up to the stalling point.

Avoid pulling up too rapidly. Your initial momentum decreases the indicated airspeed to below normal, lifts the nose higher, and makes the stall more violent.

The B-25 gives little warning in power-off stalls. Its only indication is the sluggish feel of the airplane as it loses lift.

To do power-off stalls properly, reduce the power smoothly, pull the airplane up slowly to a tail-low attitude. Maintain constant back pressure on the control column until you reach the stalling point.

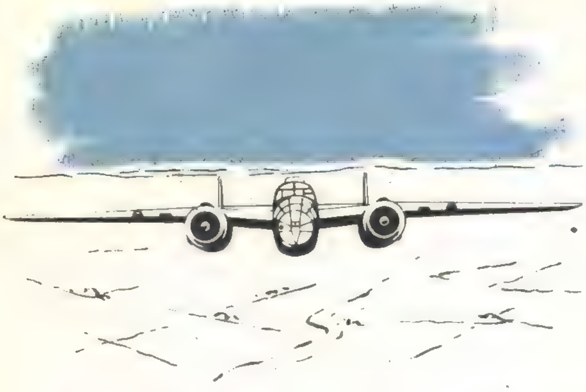
Practice simulated landing stalls from normal approaches at a safe altitude.

Partial stalls differ from full stalls in that you anticipate the stall in time to recover with a minimum loss of altitude.

PRACTICE STALLS

To completely understand the B-25 you must be familiar with practice stalls.

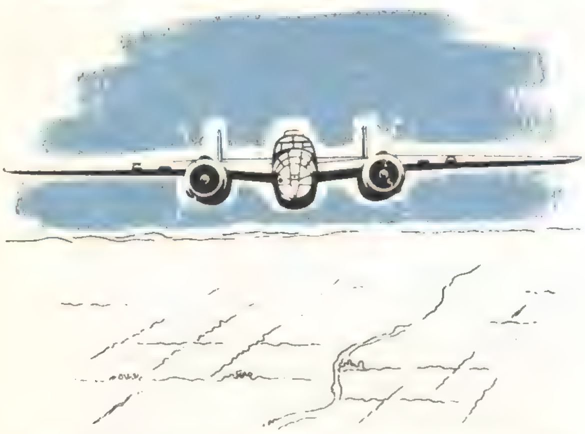
1. Gear Up, Flaps Up, Power Off—Straight Ahead



This is the first stall you do because its characteristics are less violent than the others. Use this stalling speed as a basis for comparing others.

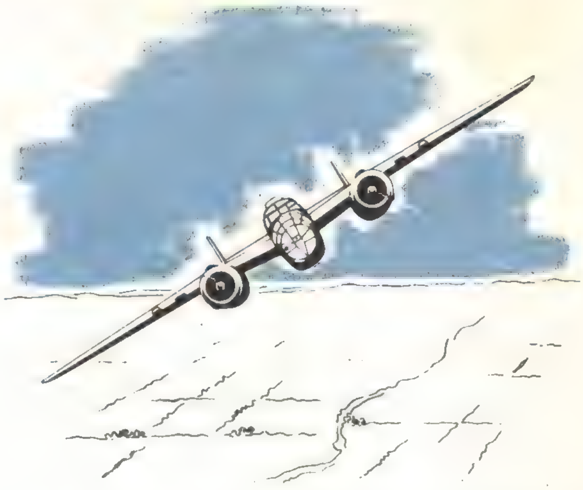
Do a secondary stall while recovering power-off. 15 to 20 mph over your initial stalling speed is enough to demonstrate the effect of abrupt control movements.

2. Gear Up, Flaps Up, Power On—Straight Ahead



This gives you the spread between power-on and power-off stalls. Notice that power decreases the stalling speed and increases the normal rolling tendency.

3. Gear Up, Flaps Up, Power On or Off—In Coordinated 30° Bank Turn

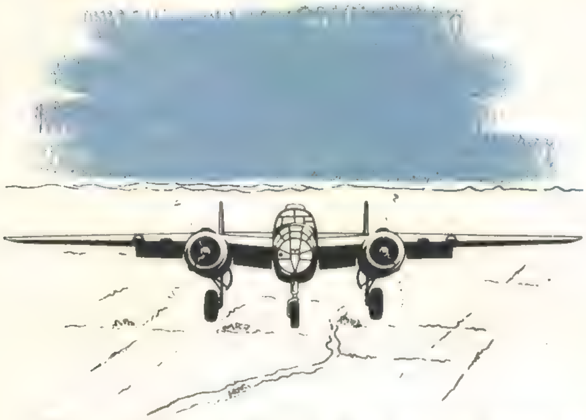


Notice the increased stalling speed. This is the result of increased wing loading in turns, as centrifugal force is added to the pull of gravity.

4. Gear Down, Flaps Up, Power On or Off—Straight Ahead

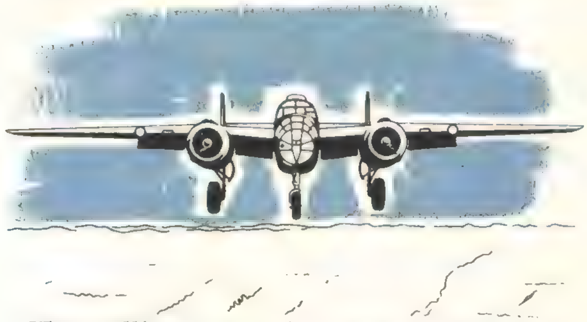
Having the gear down does not materially affect the stalling speed. However, the increased drag does cause the airplane to lose speed more rapidly. You may notice a change in stalling characteristics. This is the result of changed center of gravity and increased drag when the gear is down.

5. Gear Down, Full Flaps Down, Power Off—Straight Ahead



This stall shows the effect of the flaps on stalling speeds. It should be executed from a simulated normal landing approach.

6. Gear Down, Flaps Down, Power On—Normal Landing Approach Entry



This stall occurs at a lower airspeed than any of the others. It demonstrates to you the slowest speed at which the airplane can be flown at this power setting.

Carry this stall to the point of tail buffeting. Then make the recovery.

TYPES OF RECOVERY

1. Power Off, Nose Down

Use this recovery only for violent stalls in which you lose effective use of the control surfaces. Close the throttles, and let the nose drop below the horizon. Apply power and bring the nose back to level flight as the airspeed builds up. You experience maximum loss of altitude in this type of recovery, but it must **always** be used when a violent stall develops.

2. Power Recovery

While the airplane is in a critical nose-high position do not apply power with the intention of making a complete power-on recovery. Torque may cause a wing to drop severely and you may lose control. This type of recovery is **not** recommended in the B-25.

3. Combination Power On, Nose Down

Release back pressure from the control column and apply power smoothly. Since you regain flying speed quickly, you have a minimum loss of altitude with greater safety. **This is the normal type of recovery.**

The importance of proper recovery technique cannot be overemphasized. It is during this period that the danger of a secondary stall arises. This secondary stall may be brought on if you try to recover before you get sufficient airspeed, or if you handle the controls roughly.

Don't hurry. Make your recovery smooth and gradual. Reach safe airspeed before you try to level out.

You can recover from partial stalls either by reducing the back pressure or by adding sufficient power to obtain control without loss of altitude.

Tips

At or near the stall, hold directional control with rudder and coordinated aileron.

Know the purpose of each stall.

Use safe entry technique.

Obtain accurate airspeed readings at the stall.

To recover correctly, know the characteristics that announce the approach of the stall and the indicated airspeed at which the stall occurs.

SINGLE ENGINE STALL APPROACHES

The single engine stall approach teaches the limits of operation of the B-25 while on one engine. This maneuver also demonstrates the difficulties experienced in controlling the thrust of your good engine below safe single engine airspeed.

The B-25 has certain characteristics inherent in single engine operation. You must know these characteristics and how to handle the airplane when you experience them.

Correct Technique

Simulate single engine operation:

1. Throttle back on bad engine.
2. Prop control at DEC RPM on bad engine.

Use 25" Hg. on the good engine in this partial stall.

Pull up slowly and evenly with coordinated controls. The first indication of the properly approached stall is an even downward trend of the rate of climb indicator. Retard the throttle on the good engine and get the nose down when this happens.

If you approach the stall too fast and too steeply you lose this indication. The resulting stall may be violent.

In most instances when controls are properly coordinated the partial stall occurs before you lose directional control.

Abrupt and uncoordinated control movements in entry and recovery increase the stalling speed and exaggerate the roll tendencies.

Cut the power on the good engine when a full stall occurs. **Remember—power-off, nose-down recovery is the only safe recovery if you allow the plane to enter a full stall on one engine.**

SLOW FLYING

Practice in slow-flying shows you how you can fly power-on with an airspeed at, or slightly above, power-off stalling speed without loss of control. It demonstrates the necessity for **smooth control movements** at low speeds. It demonstrates that you can make turns at very low airspeeds without stalling. It teaches you how to use throttle and a minimum change of attitude to prevent stalls and it reveals the relationship between the actual stall and the feel and attitude of the plane as it nears a stall. It teaches you to fly by attitude. It shows the sluggish feeling and the slow reaction of the controls at low airspeed. This is a prime requisite to short-field landings. The last part of your short-field roundout and landing is slow flying, and you **must** fly by attitude and feel, not by instruments.

Correct Technique

Gain enough altitude to allow for safe recovery from an unexpected stall.

1. Set the prop control at 2200 rpm.
2. Gradually reduce power—lower the flaps and gear.
3. Bring the nose up slowly, at the same time, allowing the airspeed to drop.
4. As the airplane comes to a tail-low attitude, and approaches a stall, add just enough power to fly it between power-on and power-off stalling speed for the particular conditions.

Keep slow flying at this speed to a minimum. Most of your practice is done at speeds at, or slightly above, power-off stalling speeds. This demonstrates effectively the range of control still remaining for your normal practice.

Now take your eyes off the instruments and pay more attention to the attitude. Learn slow flying by attitude. Don't allow the B-25 to assume exaggerated attitudes. It is too heavy to respond quickly to control pressures and power.

Trimming

Don't try to trim the airplane to fly hands-off. It can be done, but it is not desirable. The trim tabs absorb too much of the feel. Take most of the control pressure off with the trim tabs, but hold enough pressure there to keep you aware of the sluggish reaction to the controls.

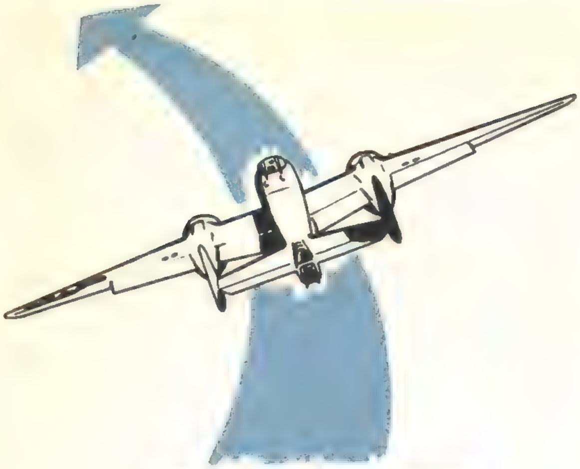
Hold the airplane in a tail-low attitude. Increase power when the airspeed gets too low, and decrease it when the airspeed gets too high. Coordinate the throttles and controls smoothly to hold the tail-low attitude.

The engines tend to overheat in a maneuver of this type. Watch the cylinder head temperature and do not allow it to rise above operating limits.

Turns

You can make turns at this low airspeed, if you remember what you learned in practicing stalls.

You must do one of two things to maintain altitude while making turns at **slow flying** airspeeds—increase power, or decrease airspeed. The latter is obviously impractical, as you are flying at a greatly reduced airspeed. **Increase**



PRACTICE SLOW FLYING TURNS

power smoothly as you start the turn. Remember—these turns must be coordinated. They take smooth handling of rudder, elevator, aileron, and throttle.

Letdown

Practice slow-flying letdowns. Reduce the power from normal slow flying and allow the airplane to lose altitude. Regulate the rate of descent with the throttles. Hold the tail-low attitude. Keep the airspeed at or slightly above power-off stalling speed. Don't become absorbed in the instruments. Fly the airplane by outside references.

Practice entering slow flying from normal flight and from a normal glide.

SINGLE ENGINE OPERATION WHILE SLOW FLYING

Remember the basic steps of single engine operation—the first two—airspeed, and directional control—are vital if the engine fails at this time.

To regain airspeed and directional controls:

1. **Reduce power.**
2. **Lower the nose.**
3. Raise the gear and flaps.
4. Prop control on bad engine to DEC RPM.

As the airspeed increases and you gain directional control, start adding power to the good engine. Continue with the normal single engine procedure as soon as you gain safe single engine speed or above.

Tips

Practice slow flying at different power settings. A constant power setting is useful at only one attitude and airspeed.

Fly the airplane by feel, with only an occasional check of the instruments.

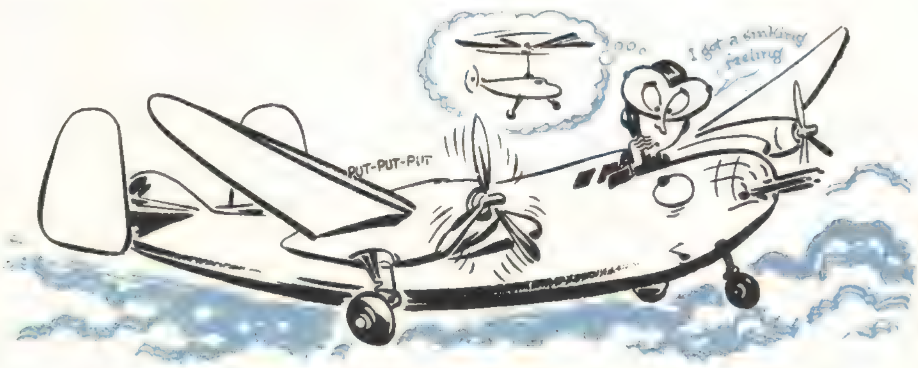
Avoid excessive cylinder head temperatures.

Avoid exaggerated attitudes.

Learn to use the throttles smoothly.

If an unexpected stall develops, lower the nose before adding power to break the stall.

Practice entries to slow flying from a normal approach glide. This is good practice for short-field landings.



Modern airplanes, with their high wing loadings, have a very steep angle of glide with power off. Use power on the approach to shallow out this angle of glide. This also gives you lower stalling speeds, greater safety, and more accuracy in landing.

Landing the B-25 involves most of the procedures presented previously. You must trim properly in order to land properly. Gliding speeds, roundout, and low speed handling are directly related to the stalls you practiced.

Correct Technique

Two types of landings are used from the power approach.

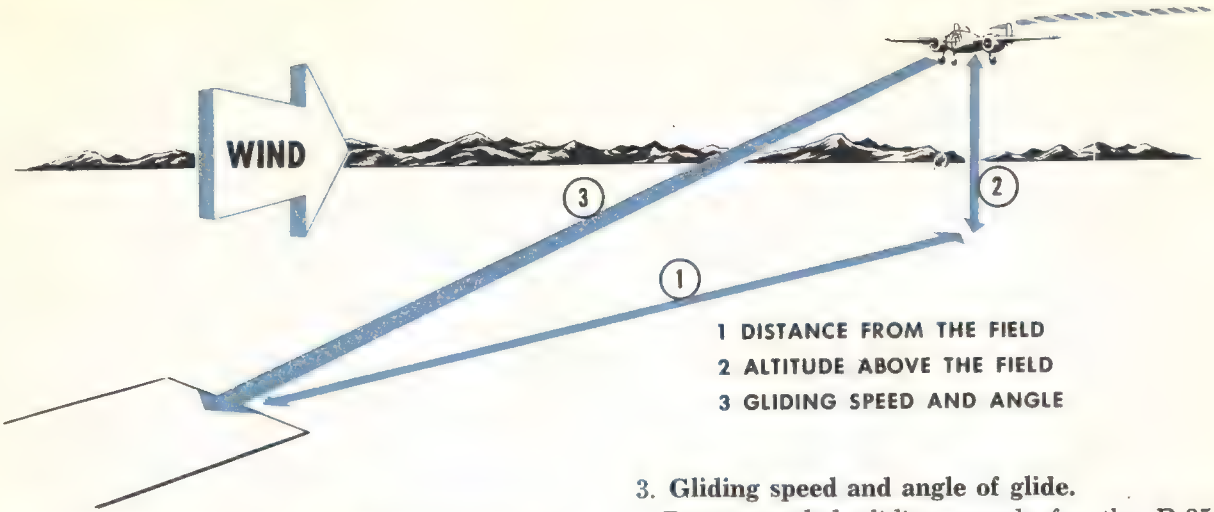
1. **Power Landing.**

This type of landing is a continuation of the power approach. A little power is used throughout the roundout and until you contact the ground. Practice this landing before you try night landings. It is very useful when surface winds are high or when your airplane is heavily loaded.

2. **Power-approach Landing.**

The power-approach landing is the normal landing from a power approach. Use power on the approach but cut it off completely for the roundout and landing. It is easy to learn, and the power approach makes it accurate.

Keep the approach speed far enough above the power-on stalling speed to insure a safe, controlled roundout. This is a precision maneuver. Your throttle settings should be constant from the top of the approach to the start of the roundout.



Four variables will effect the accuracy of every landing. They are:

1. **Distance from the field (base leg)**

Learn to set your base leg at a distance from the field that will allow you to:

1. Make a level turn onto the approach from traffic altitude.

2. Adjust power to approach setting as you complete the turn.

You should not need more than 15" Hg. on the approach.

The position of the base leg is important. If you fly the base leg too close you tend to overshoot. If you fly it too far from the field you need excess power on the approach. **Make power adjustments smoothly, and make them early on the approach.**

2. **Altitude above the field**

Maintain traffic altitude in the last turn. You always have to vary the angle of glide on the approach if you allow the altitude of your turn to vary constantly. Make practice approaches and learn to roll out, still maintaining altitude.

After the roll-out, lower flaps, adjust power, and establish the glide immediately.

Practice power-approach landings from letdown turns later in your training. The technique is the same with these exceptions: Adjust power on the base leg or the downwind leg and lose altitude in the turn. Start lowering the flaps to the desired position about 45° to a straight-in approach.

3. **Gliding speed and angle of glide.**

Recommended gliding speeds for the B-25 are:

FLAPS	POWER	AIRSPEED Below 27,000 lbs.	AIRSPEED Above 27,000 lbs.
Full down (45°)	OFF	125	135
Full down (45°)	ON	120	130
0°	OFF	135	145
0°	ON	130	140

Always hold a constant glide. Adjust the trim tabs to relieve control pressures. Keep the glide constant and aim for a point slightly short of the end of the runway. This will allow you to make accurate landings just past the runway tip.

It is difficult to make accurate well controlled landings if you allow the airspeed, angle of glide, and throttle settings to vary on the approach.

4. **The Wind**

With the flaps down, power set, the airplane properly trimmed, and the correct gliding angle and speed established, you have only one variable left—the wind. To correct for the effect of the wind, adjust the power. Since you are set up and approaching a definite point on the ground, adjust the power to keep the nose of the airplane approaching that selected point. This counteracts the effect of the wind.

Roundout and Landing

Make your roundout smoothly as you approach the ground. Reduce the power as you start the roundout. Remember—start the roundout at an altitude that allows you to apply continuous back pressure for a tail-low accuracy landing. You must land the B-25 slightly before it stalls, because the center of gravity is forward of the main gear. Lack of sufficient elevator control makes it difficult to hold the nosewheel off if you land after the stall occurs.

Land the B-25 tail-low. The main gear struts absorb the maximum amount of shock in this attitude. Change the attitude smoothly and slowly to get the correct landing attitude. Don't "horse" the controls or go down in steps.

Be sure the main wheels touch at the same time you contact the ground. The wheels and gear are designed to absorb great loads only when these loads are applied straight ahead. The tremendous forces generated in landing can collapse the gear if it is applied in a side thrust. Hold the nosewheel in the air with the elevator control, thus reducing the length of the landing roll. The increased angle of attack of the wings, plus the 45° of flaps, act as an air brake.

Lower the nosewheel slowly as you lose speed on the landing roll. Ease off back pressure and allow the nosewheel to settle slowly to the runway. Don't let the nosewheel drop heavily onto the runway. It is not designed to absorb this type of load. This may cause severe vibration at high speeds, and if you wait too long you cannot lower it under control.

Never use the brakes when the nosewheel is off the ground. This throws the nosewheel to the ground violently. Keep your heels on the floor to avoid unintentional braking.

The Landing Roll

Learn how to keep the B-25 heading straight down the runway with the rudder and with careful, restrained use of the brakes. The amount of available runway determines how much or how little you should use the brakes. Take advantage of runway space and save your brakes when possible. **Keep the throttles closed.** Use them as a last resort—added power at this time greatly increases the length of your landing roll.

Landing Tips

Don't use rough and excessive power on the approach, your airspeed and attitude will vary.

Don't cut power too high, then dive at the ground and pull up abruptly.

Avoid undershooting.

Don't approach too fast or roundout too low. This causes you to float too long before landing. A long float over the runway is also caused by leaving partial power on too long.

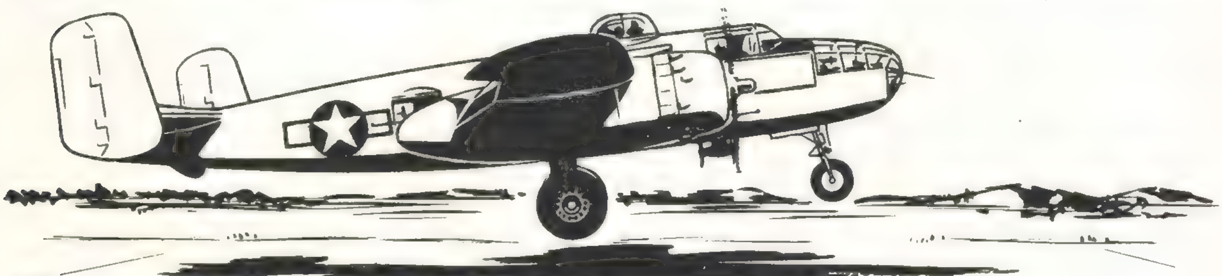
Don't let the nosewheel contact the ground with or before the main gear.

Don't apply brakes before the nosewheel is on the ground.

Don't hold the nosewheel off too long—lower it while there is still elevator control.

Guard the throttles to prevent creeping.

Land short on slick runways. Slow the airplane as much as possible without using the brakes.



Remember **KEEP ALERT WITHOUT BECOMING TENSE. A TENSE PILOT HAS LITTLE FEEL OF HIS AIRPLANE**

USE THIS PAGE TO DRAW YOUR LOCAL TRAFFIC PATTERN

POWER-OFF LANDING

Power-off landings emphasize the capabilities and limitations of the B-25 under power-off conditions, and develop accurate judgment of the correct gliding angle.

Correct Technique

Keep your approach airspeed enough above power-off stalling speeds to allow a safe, controlled roundout and landing.

The key points for accurate power-off landings are the same four variables you learned to handle in power-on landings. Remember the importance of first dealing with the three controllable variables—distance from the field, altitude, angle of glide and airspeed.

Set the base leg where you can make a level turn onto the approach.

If the size of the traffic pattern does not permit a base leg suitable for power-off landings, hold traffic altitude during the first part of your approach. When you reach the point at which you wish to start your glide, cut the power completely, lower the flaps, and establish gliding speed.

Hold the Glide Constant

You cannot maintain constant airspeed if you vary the angle of glide. If both the airspeed and the angle of glide change, it is difficult to tell where the airplane will land. With full flaps down, the airplane trimmed properly, the correct angle of glide and gliding speed established, you have only one variable to cope with—the wind. Try to estimate the effect of the wind as you approach the field. Counteract its effect by varying the spot at which you cut the power. Correct the mistakes you make by using power.

Roundout and Landing

Start your roundout slightly higher than you did for the power-on landings. Remember—make your roundout smoothly and evenly as you approach the ground.

The actual landing and landing roll are identical with those of a power-approach landing.

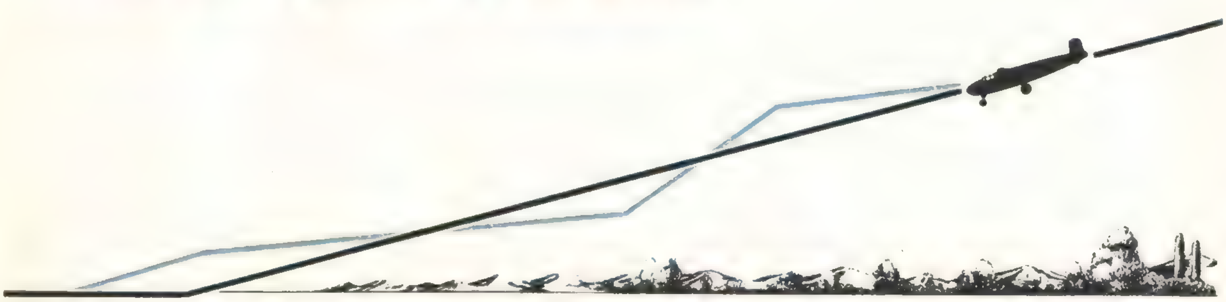
Tips

Establish a definite glide at the top of the approach.

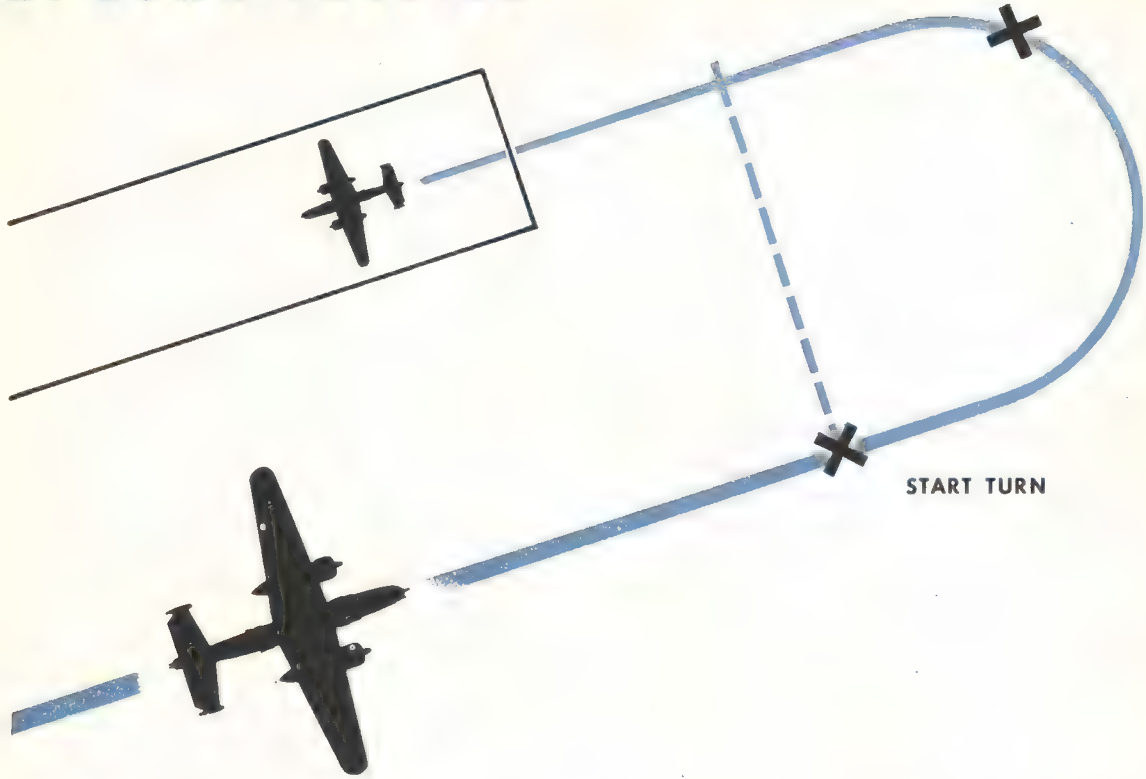
Don't start your roundout too late or make it too fast. This causes you to balloon or float excessively.

Don't start your roundout too soon. This causes you to level off too high and stall into the runway.

Hold the Glide Constant



LET-DOWN LANDING



A slow-flying bomber with wheels and flaps down is a setup for any fighter which spots it. To get your plane out of the air and onto the ground quickly use this procedure. You can use it equally well from a 180° or a 90° approach.

If you use a downwind leg fly it exactly as you do in the other power-on landings. When you are slightly beyond the end of the runway start a turn into the field. Play your speed and altitude in a constantly descending turn. Start lowering your flaps when you are 45° from a straight in approach. They will be full down when you roll out above the runway.

Don't make tight steep turns close to the ground. Go around and take another crack at it if you can't line up properly without racking the plane up in a steep bank at a low altitude.

Properly executed you can complete this roll out just above the end of the runway at a speed that permits the minimum amount of float above the runway before touching down.

If you visualize a chandelle and then reverse it so that you picture a diving turn through 180°, you have an accurate picture of this landing.

To make this landing from a 90° approach simply play the speed and altitude through 90° of turn instead of 180° of turn.

Once you are on the runway the rest of the landing procedure is the same as any other landing.

Caution

THIS MANEUVER REQUIRES THE TOUCH AND SKILL OF AN EXPERIENCED PILOT. HAVE AN INSTRUCTOR PILOT DEMONSTRATE IT TO YOU AND PRACTICE IT WHEN HE IS PRESENT.

NO FLAP LANDING

Occasionally both in combat and normal operations your plane may be damaged to the extent that flaps cannot be lowered for landing. The use of full flaps reduces your landing speed approximately 20 mph; therefore, a slightly different technique is required for landing when using no flaps.

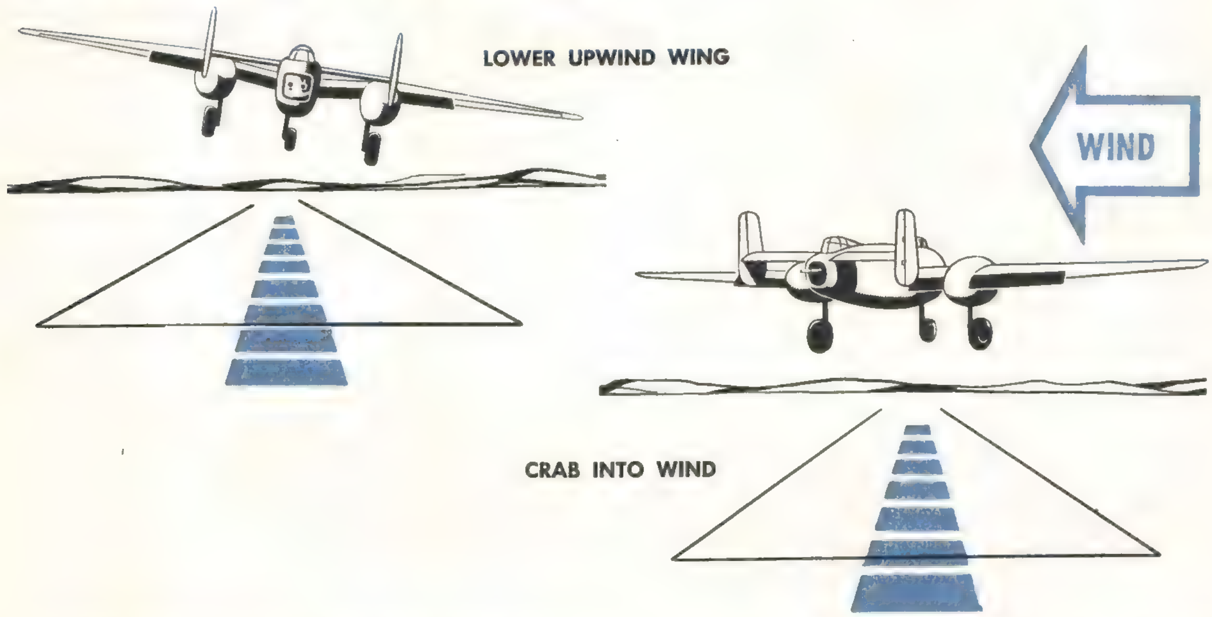
You must be familiar with this technique:

1. Add approximately 10 mph to your normal gliding speed.
2. Keep the plane's attitude almost level on the approach.
3. Use less elevator control and more power than normal in the roundout. (In some instances, it may be necessary to use considerable power to decrease your rate of descent.)

Note: When making no-flap landings **always** land on the first few feet of the runway. Your landing speed is greater and your landing roll much longer.

Don't let the nosewheel touch the ground before or with the main wheels.

CROSSWIND LANDING



Crosswind landing in the B-25 requires accurate flying, to save the plane from unnecessary structural stresses. You must land the airplane smoothly to prevent blowing a tire, collapsing a strut, or exerting side loads on the gear.

There are three possible ways to land crosswind:

1. Hold the airplane straight and level toward the landing strip and drop one wing into the wind to counteract drift.
2. Crab into the wind to keep a straight ground path.
3. A combination of the two methods.

The third method is the best. Crab into the wind, then lower a wing. This prevents you from dropping a wing too low or crabbing too much, and it makes it easier to straighten out.

Any uncoordinated movement such as a slip raises the stalling speed. At the speeds you must fly, a slip and the consequent stall spell disaster.

Once again, the secret of the landing lies in the approach. Allow for drift on the turn into the approach, and do not overshoot or undershoot the approach leg. Correct for drift as soon as possible on the approach, making a straight path to the landing strip.

If there is only a moderate wind, use full flaps; with a stronger wind, use less flaps. If no flaps are used, a long ground roll will result. As you begin to roundout for landing, bring up the low wing and straighten the airplane so that there is no side load on the gear as it touches the ground.

You may have to use fairly hard rudder pressure just before contact to straighten the airplane properly.

After the plane is on the ground and has reached a three-point position, there will be a tendency to weathervane into the wind. Hold a straight course by lowering the downwind aileron and using the drag on that aileron to counteract the weathervaning tendencies. The stronger the crosswind, the greater the force exerted on the downwind aileron.

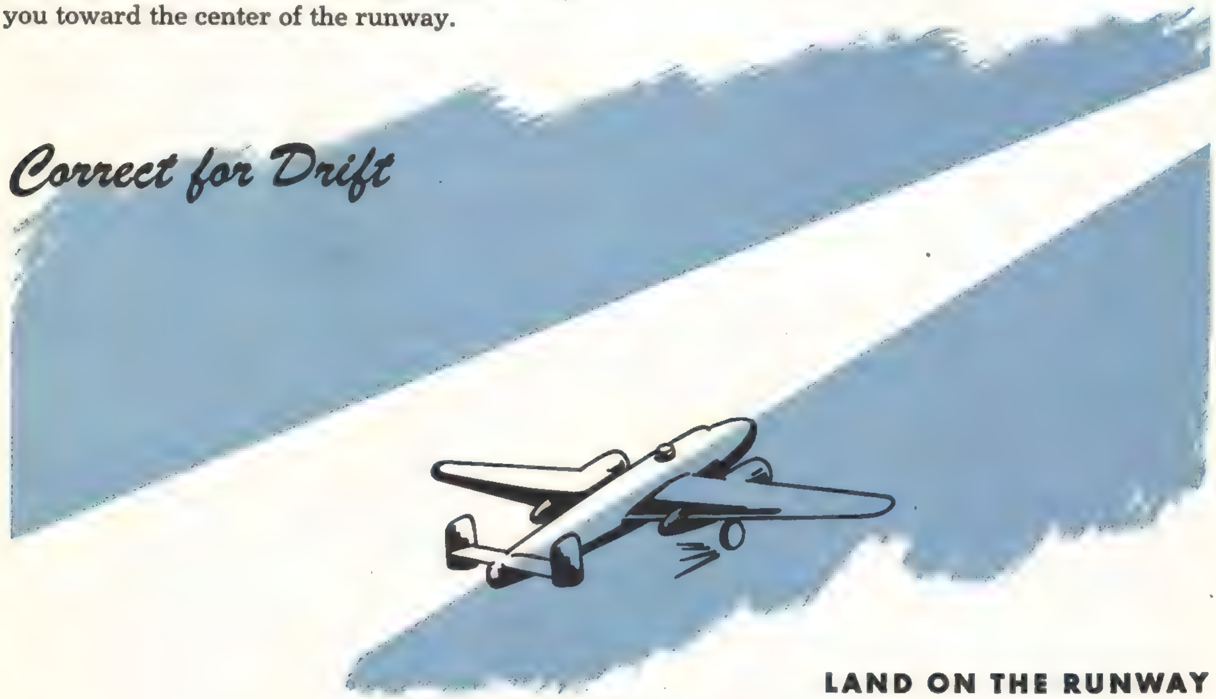
Use full rudder if necessary. As a last resort, make very cautious use of the downwind brake, and smooth use of the windward engine. Never blast out roughly with the throttle, as this just aggravates the control of the ship and strains the landing gear. Use of throttles increases the length of roll considerably.

Where there is a strong drift, land on the upwind side of the runway. The drift will carry you toward the center of the runway.

Common Errors

1. Failure to correct properly for drift when turning into the approach.
2. Failure to correct completely for drift, thereby turning onto the runway at an angle. This makes a good landing difficult or impossible.
3. Failure to recognize drift. This occurs frequently in moderate or slight crosswinds, although seldom where there is a runway to land on.
4. Failure to push the airplane straight on the actual landing, thus putting a side load on the gear. Avoid the tendency to straighten the plane out too high off the runway. If the plane stays in the air long enough it will drift off course and may land with one wheel off the runway.

Correct for Drift



LAND ON THE RUNWAY

Go-Around Procedure

There is a common reluctance among pilots to go around. They feel it implies a lack of ability to meet an unusual situation.

A pilot admires a buddy who has sufficient moral courage to go around when the situation seems to call for it. Yet he believes his fellow pilots will censure him for the very thing he admires in another.

Don't be a dope! Go around when you must.

The go-around procedure is an important emergency maneuver. It is not difficult, but it requires practice.

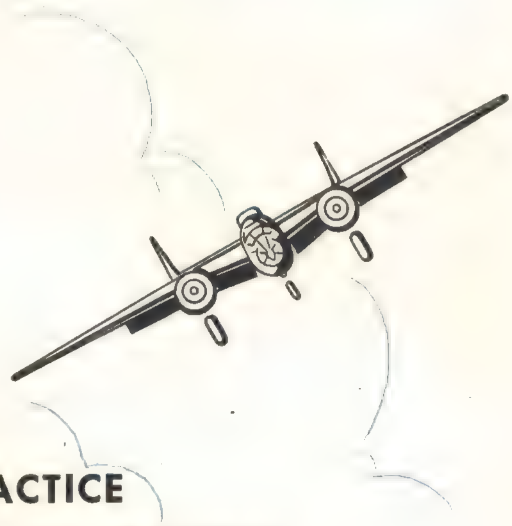
Since the go-around procedure may begin at extremely low altitudes and airspeeds, with wheels and flaps down, its relation to slow flying and full-flap maneuvering is obvious. Practice these maneuvers before practicing the go-around.

Practice full-flap turns at safe altitudes to experience the feel of the lower airspeeds at which these turns may be made.

It is not true that the flaps will blank out the tail surfaces at a certain degree of bank.

Do not make abrupt steep turns, however, as the stalling speed increases with the degree of bank, and abrupt control movements might precipitate a stall.

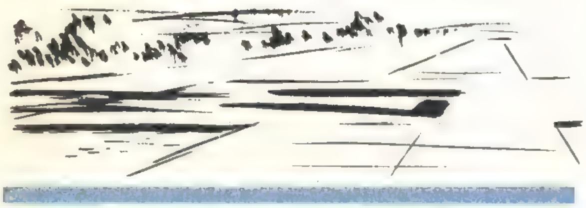
The most important part of the go-around procedure is determining its necessity and starting it soon enough. When it is necessary to go around, the sooner you start the procedure the easier it is.



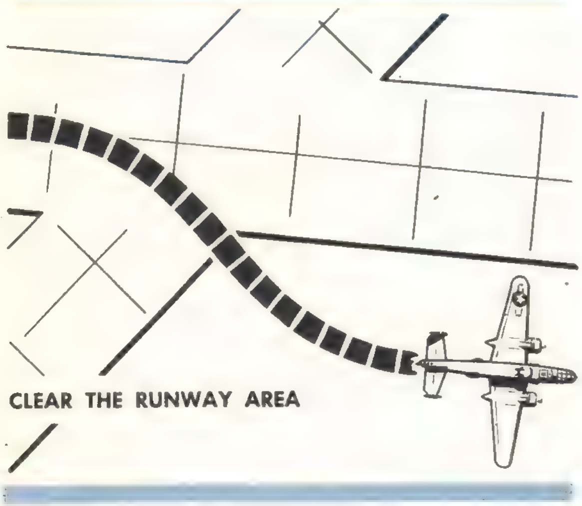
PRACTICE
FULL FLAP TURNS

GO-AROUND PROCEDURE IS AS FOLLOWS:

ADVANCE THROTTLES—RAISE WHEELS



RAISE THE FLAPS TO 15°



CLEAR THE RUNWAY AREA

1. Keep the prop set at 2200 rpm.
2. Advance the throttles smoothly, increase the rpm if necessary.
3. **Keep the nose of the plane down.**
4. Raise landing gear.
5. Raise the flaps slowly to 15°.
6. Allow the plane to settle to a slightly lower altitude, if necessary, to maintain or increase the airspeed.

With the plane trimmed for landing there is a strong tendency for the nose to lift when power is applied. This will throw the plane into a stall if it is not counteracted.

When the plane has gained sufficient airspeed, pull over to one side of the runway, thus clearing the runway for any plane attempting to take off or land.

Keep an eye on all planes near you! The pilot taking off under you may not know that you are there.

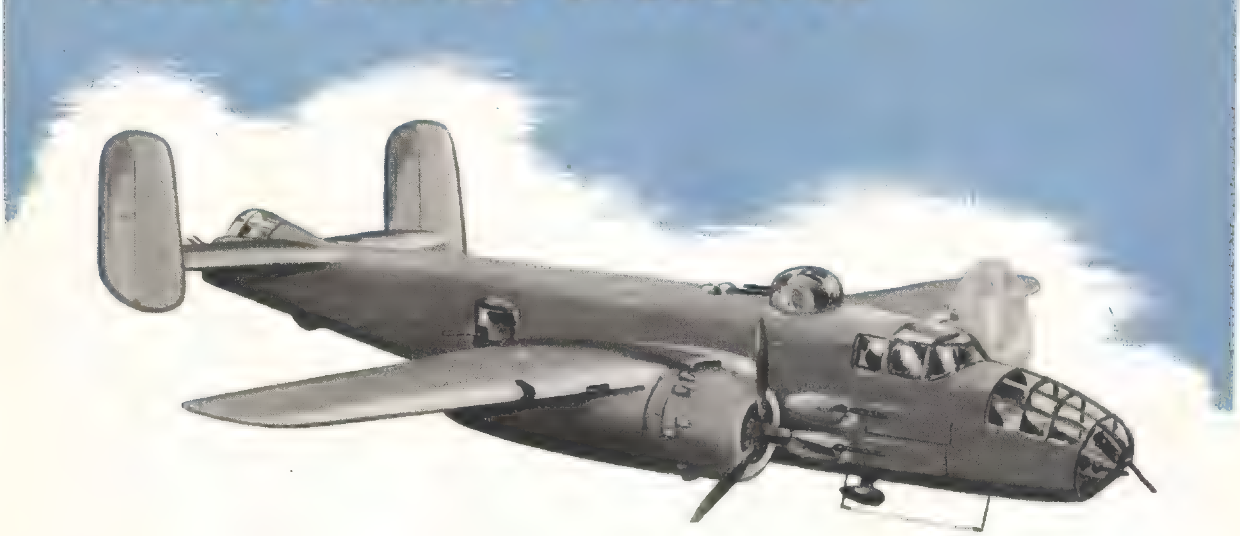
As soon as you gain sufficient speed, raise the balance of your flaps. Establish a normal climb, break traffic, re-enter traffic as before and make a normal landing.

Don't hesitate to go around. Any doubt that the plane is under perfect control is sufficient cause to go around. If you have made a poor approach and know that the landing will be too long, or too rough—go around.

Common Errors

1. A reluctance to go around or failure to anticipate the necessity.
2. Waiting until the airplane is too low and moving too slowly before deciding to go around.
3. Failure to add sufficient power or adding power too slowly, thus losing altitude.
4. Raising the wheels before applying power.
5. Starting climb without a safe airspeed.
6. Raising the last 15° of flaps without increasing the angle of attack of the wings, causing an uncontrolled sinking.
7. Tenseness, causing a hurried procedure. Learn the procedure thoroughly, use it with confidence, perform each step calmly and deliberately as needed.

SINGLE ENGINE OPERATION



Once you master single-engine procedure you can fly and land the B-25 safely if an engine fails. The loss of an engine after you reach safe single-engine speed is not a serious problem—if you know and use the proper technique for maintaining sufficient airspeed and directional control.

Safe Single-Engine Speed

Safe single-engine speed is the lowest speed at which you have a safe margin of control over the maximum unbalanced thrust of one good engine. Any added speed that you can get and maintain above this minimum speed, without overworking the good engine, is highly desirable.

Safe single-engine speed for the B-25 is 145 mph (or any higher airspeed).

MAINTAIN SAFE SINGLE-ENGINE SPEED AT ALL COSTS. This is the most important part of single-engine procedure. It is much better to fly an airplane into the ground under control than to spin in.

A simple seven step procedure is the basis of single-engine operation in any airplane. Learn these steps well and you can apply them, with slight variations, to any airplane you fly.

Single Engine Procedure

1. Airspeed
2. Directional Control
3. Adjust Power
4. Reduce Drag
5. Reduce Fire Hazard
6. Trim
7. Trouble Search

This does not mean that you do the same thing each time regardless of flight conditions. Your technique varies with the flight conditions at the time of engine failure. The technique used depends on the speed and altitude at the time. Use different techniques—(1) on takeoff, (2) in or approaching a stall, and (3) in normal flight.

Now let's amplify this basic procedure:

1. **Airspeed**

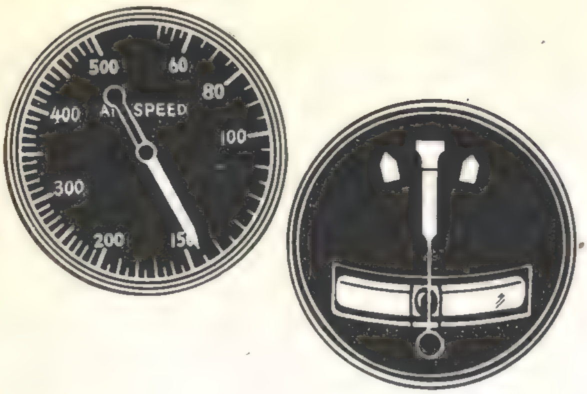
Get the airspeed to 145 mph (or faster) and keep it there even if you have to lower the nose and lose altitude to do so.

2. **Directional Control**

Maintain directional control by coordinating rudder and aileron properly.

3. **Adjust Power**

If the power settings are high and the air-



speed low (as in takeoff) you may have to reduce power to prevent loss of directional control. If the power settings are low and the airspeed high (as in normal cruise) increase power to the limit allowed by airspeed and directional control.

Set the prop controls at 2400 rpm or, if necessary, to takeoff rpm. You may have to use maximum power on your good engine. To use maximum power you must **first** increase **rpm** to prevent detonation.

Advance throttles to 33" Hg., or to takeoff power. Advance both throttles and both prop controls. This prevents accidental power reduction on the good engine.

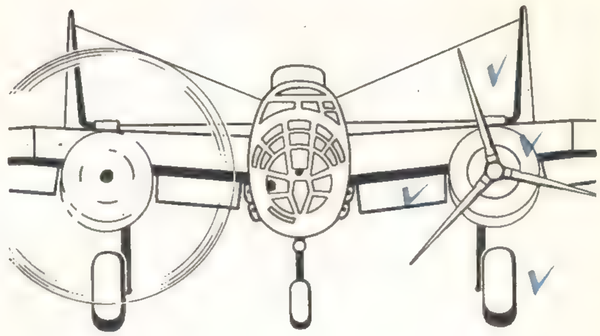
Find out whether the bad engine has any usable power. If it has use this power in an emergency.

4. **Decrease Drag**

Check the gear and flaps. Get them up if they are down. Trim if necessary.

Dead Engine Controls

Pull back throttle, prop, and mixture control. Feather the prop.



Caution

Hold the button down if the prop does not feather fully before the feathering button pops up. When the prop is fully feathered pull the button up. If no feathering action is observed in 90 seconds release the button.

5. **Reduce Fire Hazard**

Fuel shut-off valve OFF.
Lux system to dead engine.
Switches OFF after the prop stops turning.
Cowl flaps and oil shutter coolers as desired.

6. **Trim**

Make final adjustments on the trim and power settings.

If the airplane is maintaining excess airspeed above safe single-engine speed (170-180 mph) reduce power to maintain a lower airspeed (150-160 mph). This reduced airspeed lightens the load the good engine must pull, thus conserving it for future needs.

7. **Trouble search**

In case of abrupt engine failure, check ignition switch and fuel valve positions while accomplishing normal single engine procedure.

Turn the vacuum selector switch to the good engine to obtain proper operation of the flight instruments.

Try to find out what caused the trouble, and if possible make temporary repairs. Check all fuses, switches, pop-out buttons, valves, lines and wiring as well as you can.

Don't try to restart the dead engine if you don't know what is wrong. It is much simpler to make a single engine landing than to fight a fire in the air.

Reduce weight if the plane is excessively heavy. Drop bombs, bomb bay tank, tools; in fact, anything that will come loose if it is necessary. Make adjustments on the trim and power settings if you drop weight.

Now let's apply this single engine procedure to the varying tests of flight conditions.

Engine Failure on Takeoff

Observe these three rules when an engine fails on takeoff:

1. Cut the throttles and stop straight ahead if the engine fails before you leave the ground.
2. Cut the throttles and land straight ahead if the engine fails after you leave the ground, but before you reach safe single engine speed.

If you have not retracted the gear and enough runway remains, land and stop the plane with the brakes. If you have not retracted the gear and there is **not** enough runway remaining, **retract the gear immediately.**

3. If you have reached safe single engine speed before the engine fails follow normal single engine procedure.

Engine Failure During Normal Flight

Use normal single engine procedure.

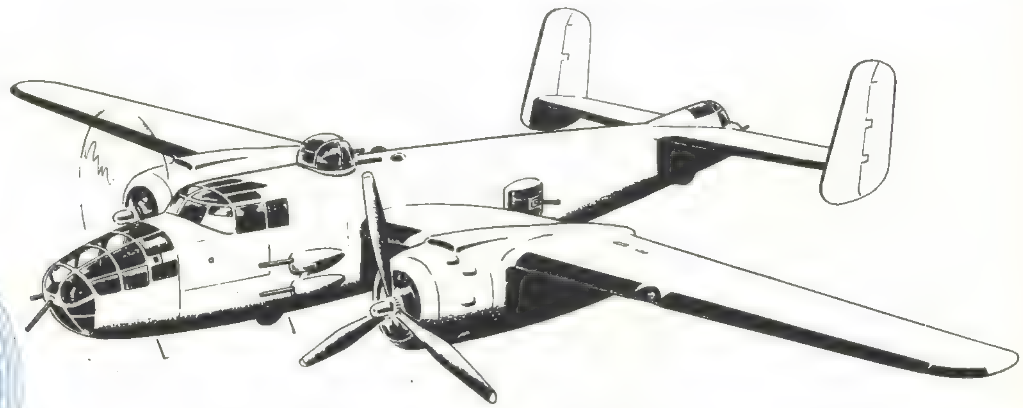
Engine Failure In or Approaching a Stall

Cut the power and lower the nose if an engine fails at low airspeed. This is normal recovery procedure for the partial stalls you practice with the power reduced on one engine.

As soon as you gain safe single-engine airspeed use the normal single engine procedure.

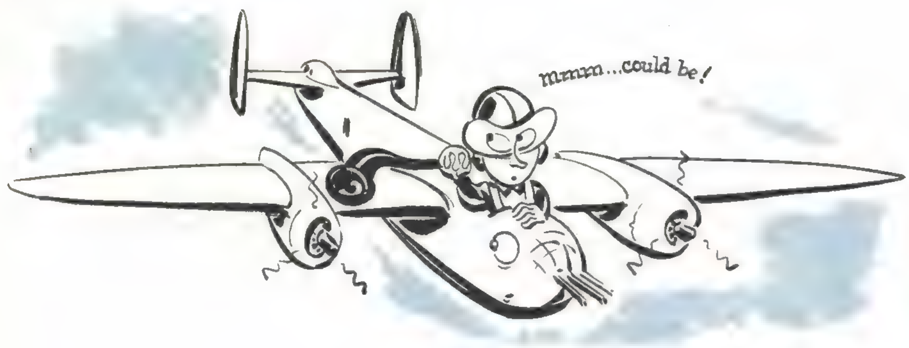
Airspeed and Directional Control

The key to single engine procedure is in attaining airspeed and directional and control. Takeoff—normal flight—low speed flight, it is always the same problem. Get a safe airspeed so that you can maintain directional control. Once you have the plane under control you have licked the problem of flying on one engine.



MAINTAIN SAFE SINGLE-ENGINE SPEED AT ALL COSTS

TIPS ON SINGLE-ENGINE OPERATION



Learn and remember your single engine procedure by these steps: (1) Airspeed; (2) Directional control; (3) Adjust power; (4) Reduce drag; (5) Reduce fire hazard; (6) Trim; (7) Trouble search.

Learn to recognize loss of power in an engine before it fails. Overheating, rough operation, and loss of fuel or oil pressure normally precede engine failure. Keep a close check on your instruments. If you detect any of these conditions reduce the power on the faulty engine and try to determine the cause of the trouble. Don't hesitate to cut off a failing engine if it is necessary to maintain safe flight.

Never use the manifold pressure gages to determine which engine is dead. Here are two sure ways to find out which engine is out:

1. The right engine is out if you have to hold right rudder.
2. The plane tries to turn into the dead engine.

Don't get panicky if an engine fails. Work quickly, but calmly and accurately. B-25's have flown hundreds of miles on one engine for other pilots; they will do the same for you if you give them a chance.

Practice single engine operation with the prop feathered for a maximum of 5 minutes in cold weather and 15 minutes in warm weather. If you exceed these time limits the engine cools too much.

Warm up the engines gradually when recovering from single engine operation.

The B-25 may lose altitude slowly at high altitudes. However, where the air is more dense, it holds altitude easily with wheels and flaps up and the dead engine prop in low rpm or feathered.

Your engine instruments won't always give an immediate indication of which engine is out. **Failure of an instrument does not necessarily mean failure of an engine.**

Never let the airspeed drop below safe single-engine speed.

Don't advance the throttles before the props are at the proper rpm.

After the plane is under control, don't get confused and feather the wrong prop, or cut the power on the wrong engine.

If the feathering system is working properly it is not necessary to hold the feathering button down to feather the prop. Push it in, it will pop out automatically when the prop is feathered.

If the prop feathers, then attempts to unfeather before the feathering button pops out, pull the button up manually to stop the unfeathering action.

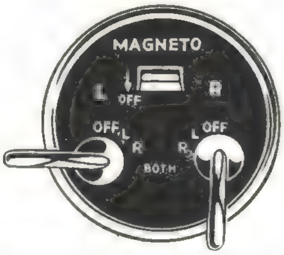
If you accidentally push the wrong feathering button pull it out immediately to stop the feathering action.

Always hold the feathering button down to unfeather the prop. Pull it out manually when the engine reaches 800 rpm.

Resuming Normal Flight

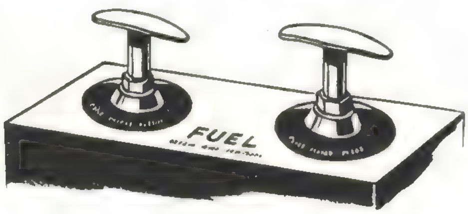
You have not completed the simulated single-engine drill until you are again operating on both engines. This is the correct procedure for starting the dead engine.

1. Ignition switch ON

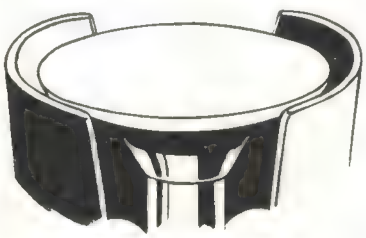


2. Mixture FULL RICH

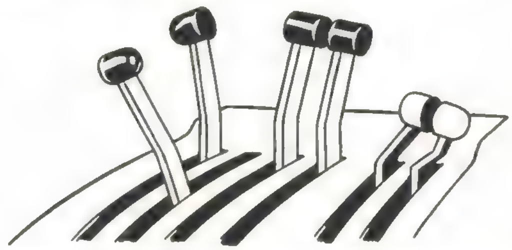
3. Fuel shut-off valve ON



4. Depress the feathering button and **hold it down** until the engine reaches 800 rpm. Release the feathering button and resume control of the engine with the engine controls.



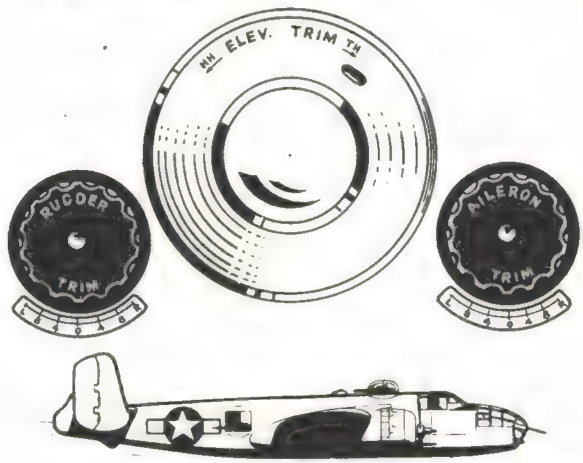
5. Move the prop control and throttle ahead slowly. Don't exceed 1500 rpm and 15" Hg. until the cylinder-head temperature starts to rise; in this way you won't get excessive power from the engine before it is warm enough to be properly lubricated.



Warm the engine as you would on the ground and apply cruising power after the cylinder-head temperature is within normal operating limits. Roll off trim as you apply power. You can apply power and roll off trim in alternate steps.

6. Adjust oil shutters and cowl flaps as desired.

7. Re-trim for normal flight.



SINGLE-ENGINE AIRWORK

The following single-engine airwork gives you a complete picture of the factors involved in most single-engine flight.

Following single-engine drill, if you want to practice single-engine airwork before resuming two-engine flight, follow this procedure.

1. Start the dead engine.
2. Set the dead engine prop control even with the good engine prop control.
3. Set the dead engine throttle at not more than 12″ Hg.

This helps to keep the cylinder-head temperature near the minimum starting temperature and simulates the effect of a feathered prop. It also allows the use of the dead engine if it becomes necessary in an emergency.

Single-engine Turns

After you are proficient in single-engine procedure, and prior to practicing single-engine landings, practice single-engine turns. Single engine turns can be made in either direction, and should be practiced as an emergency procedure. Sometimes it is safer to turn into the dead engine than to go around to make turns into the good engine.

You can make single-engine turns safely in either direction if you use the right technique. You cannot turn safely in either direction if you don't.

Roll into the turn smoothly and slowly.

Hold the airspeed constant. The value of a constant airspeed cannot be overemphasized. It is the key to safe single-engine turns. Hold the speed for which you were trimmed when you rolled into the turn. Lose altitude if it is necessary but, hold that airspeed constant. As long as you keep a constant airspeed the thrust of the good engine is balanced by the trimmed rudder.

Make turns at medium and shallow angles of bank. Remember that the stalling speed increases with the angle of bank and the plane is more difficult to control in steep turns. Never make steep turns at a low altitude.

Hold the nose down when you roll out of the turn or you will lose airspeed. The plane will try to climb as the lift increases when you roll out.

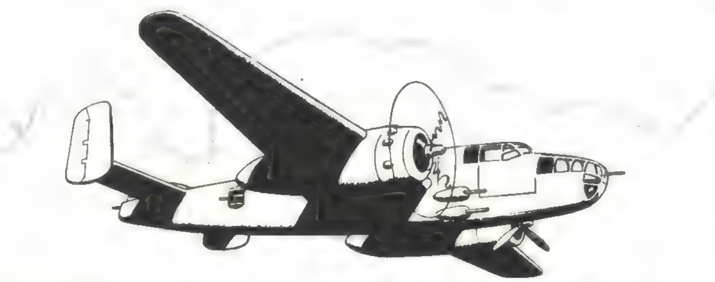
Don't blast the throttles during the turn. It is better to keep the power constant and lose a little altitude.

Do

- Keep the plane trimmed
- Hold the airspeed constant
- Lose altitude to maintain airspeed if necessary
- Keep the controls coordinated
- Make control movements smoothly and slowly
- Keep the power settings constant
- Hold the nose down when you roll out of the turn

Don't

- Allow the airspeed to vary
- Blast the throttles to maintain airspeed
- Bank steeply at low altitudes
- Make rough, jerky control movements



A TURN INTO THE DEAD ENGINE IS OK IN AN EMERGENCY

Propeller Drag

Determine the drag effect of an unfeathered propeller on the B-25. To do this, trim the plane for hands-off flight with the prop in low rpm and throttle back. Then advance the dead engine prop control to a position even with the good engine prop control. As the prop changes pitch, the additional drag causes the plane to turn into the dead engine. Apply additional rudder pressure to counteract this and hold the plane straight.

Airspeed Effect

Trim the plane properly and hold constant power settings. Practice increasing and decreasing the airspeed by lowering and raising the nose. The trim becomes more effective as the airspeed increases because of the increased airflow over the control surfaces. This causes the plane to turn into the good engine. The reverse of this is true when you reduce the airspeed.

Power Effect

Practice directional control with the throttle. To do this, trim the plane for hands-off flight. Decrease the airspeed by raising the nose. As the airspeed decreases, keep the plane from turning into the dead engine by smoothly reducing the power of the good engine.

Engine Failure at Low Airspeed

Simulate single-engine procedure on take-off or normal go-around at safe altitude, with the airspeed well below SSE speed. Then do it with the airspeed just below or at SSE speed. This exercise prepares you for the possibility of engine failure at low airspeed.

SINGLE-ENGINE GO-AROUND

Simulate a single-engine landing at a safe altitude. On the approach in this simulated traffic pattern, lower the gear and put down ½ flaps. Reduce the power as you would in a normal single-engine approach at 145 mph.

Increase the power and notice the effect carefully.

Now repeat this exercise at 120 mph with full flaps down. Again observe the effect carefully.

Practice this exercise at a safe altitude. It will show you how much power you can use during single-engine landings, and exactly how to control the plane with varying amounts of power at different airspeeds.

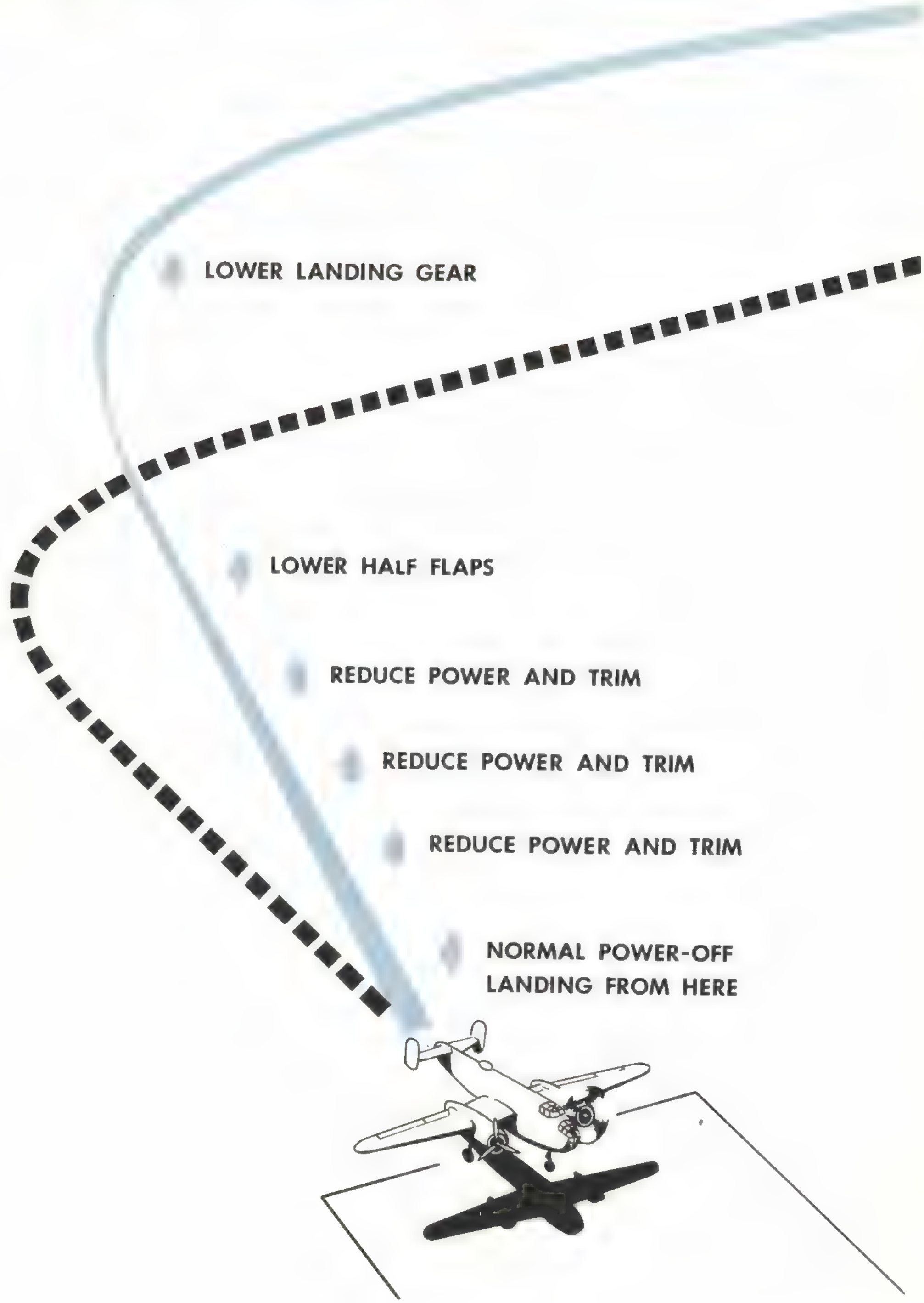
Correct Technique

Simulate a single-engine landing approach. To go-around:

1. Apply power to the good engine smoothly.
2. Reduce drag by moving the "dead" prop control back, and raise the flaps and gear.
3. Re-trim the plane as necessary.
4. **Never let the airspeed drop below safe single-engine speed.**

Practice this maneuver at a safe altitude and notice how much altitude is lost in completing the maneuver.

Single Engine Landing



Single-engine landings are practicable. Practice them a little and any lingering doubts you may have about single-engine operation will be forgotten. You have seen that it is entirely possible to fly the B-25 with one good engine, and to make turns in both directions. Now see for yourself how you can make a perfect landing with one good engine.

Correct Technique

Simulate an engine failure in the traffic pattern. Use normal single-engine procedure with these exceptions:

1. Simulate cutting the mixture control, ignition switches, and turning the fuel shut-off valves OFF.
2. Instead of feathering the prop move the desired prop control to "DEC RPM."
3. Use 12" Hg. (or less) to simulate a feathered prop.

Decide whether it is advisable to establish a base leg. If it is possible and you have enough altitude, set the base leg the same distance from the field as you would for a normal power approach.

As you complete the turn onto the approach, reduce the power on the good engine if necessary. Aim the nose of the plane directly behind the end of the runway. Adjust power to keep from picking up too much airspeed. Keep the airspeed at or slightly above safe single-engine speed.

When you are sure you will reach the field, lower and check the landing gear. (Warning—in an actual emergency it takes the gear longer to come down when only one hydraulic pump is working.)

Adjust trim and power as necessary. Check mixture and prop control.

When you are certain you can reach the field with the gear down, lower as much flaps as you need. Flaps can be started down at the same time gear is lowered if necessary. At ¼ to ½ flaps and safe single-engine speed, you can add power without giving the airplane an excessive tendency to roll. Keep some flaps in reserve, however, you will need them if you start to overshoot the field.

From this point on, your main concern is to adjust power and trim. Leave a slight amount of rudder trim on in case it is necessary to use power on the good engine. When you are sure of a safe landing (you can't be sure until you are down to about 300 ft.), eliminate excess airspeed by reducing power and lowering the remaining flaps as necessary. The idea is to utilize your remaining flaps in the last stages of the approach just before the roundout. The flaps act as a brake. They reduce excess airspeed and give you a slower landing speed.

REMEMBER: As you reduce power completely on the live engine, cut back the power on the simulated dead engine.

Tips

Don't let the airspeed build up excessively when you are turning onto the approach. This has ruined many single-engine landings.

The ideal method is to reduce the power by degrees throughout the approach.

Be careful to maintain safe single-engine speed until the landing is a sure thing.

Don't overshoot. You may, if you set the base leg too close, use too high an airspeed on the approach, fail to reduce power soon enough, fail to use flaps, or take too much time to carry out procedures on the approach.

Do not forget to lower the landing gear. You may, because you violated your normal habit of lowering gear, and didn't make the landing check properly.

Don't attempt a complete power-off landing, because there is no possible correction if you overshoot.

Avoid undershooting and using too much power. With full flaps down, this can get you into serious difficulties. Lift is greatly increased on the good engine wing—this exaggerates rolling tendencies.

If you overshoot, or in case of an emergency, carry out go-around procedure before you reach an altitude of 500 feet above the ground.

SHORT-FIELD TAKEOFF

The short-field takeoff is an important operational maneuver. You can easily understand its importance if you stop to consider that the first Tokyo raid could never have been made without its use.

Many tactical fields have been kept open after a severe bombing simply because our pilots were proficient in this maneuver.

Heavy planes with high wing loadings must often be flown from small fields. The combination of large bomb loads, full fuel cells, loaded ammunition boxes, and poor runways, makes high demands on your skill. Since these loads are gone at the completion of a mission, the landing must take second place to the takeoff wherever the combat operation of the airplane is concerned. Successful short-field takeoffs call for maximum use of every favorable characteristic of the plane. They are directly related to your future as an operational pilot.

The short-field takeoff is a maximum performance maneuver. Know your stalls and slow flying before practicing it.

How

1. Complete the normal pre-takeoff check. In takeoff position:
2. Hold the airplane with the brakes and make the engine run-up.
3. Check the engine instruments.
4. Release the brakes and use the remaining power to hold the airplane straight.
5. Set both throttles evenly at takeoff power as rudder control is gained.

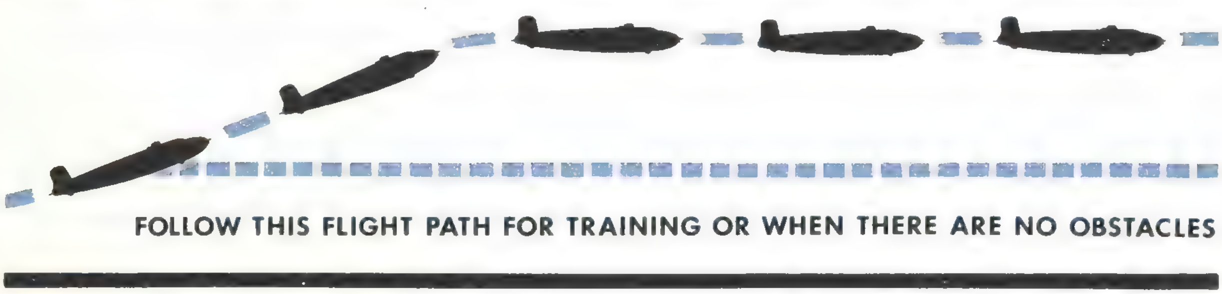
Lift the nosewheel as quickly as possible. Aid the airplane to leave the ground after wheels down, flaps down, power-on stalling speed is reached. This technique gets you into the air in a hurry.

(Normal training procedure is—lower the nose and gain safe single engine speed at this point.)

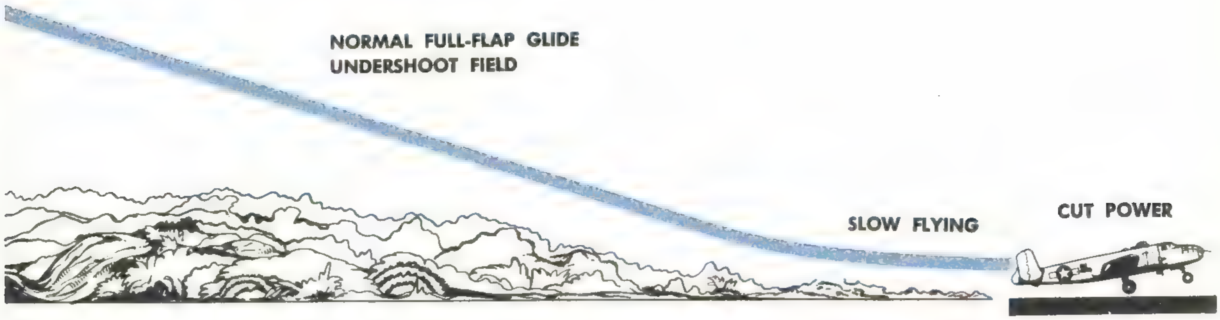
When definitely airborne, retract the wheels, and allow the airspeed to build up slightly. Climb to clear any obstacle. When you clear surrounding obstacles, lower the nose, raise the flaps to 15° and get safe single-engine speed.

RELEASE BRAKES • RAISE NOSEWHEEL • RAISE WHEELS WHEN AIRBORNE

CLIMB TO CLEAR OBSTACLES • LEVEL OFF • RAISE FLAPS TO 15° • GAIN SSE. SPEED



SHORT-FIELD LANDING



Operational pilots face varying field conditions in their day to day flying. Landing fields may be small, or bombed so heavily that little landing space remains. There may be emergencies when the brakes are useless. They may have to land on ice coated runways.

Training in short-field landings enables you to master these difficulties. It develops your flying technique, and improves your normal landings. If you hesitate to use normal gliding speeds, practice in short-field landings corrects this fault.

These maneuvers are the basis for short-field landings:

1. Power-on, wheels-down, full-flap stall
2. Power-off, wheels-down, full-flap stall
3. Slow flying

Technique

Set your base leg to establish a normal power approach. Set the glide to **undershoot** slightly. This is the key to a good short-field landing.

Hold the normal approach speed from the top of the approach until you start the roundout. Reduce the power at this point. Try to make the roundout in the shortest possible distance.

Make corrections early on the approach, if you are undershooting or overshooting. Correct by varying power settings, and changing the angle of glide to hold a constant airspeed.

Increase the power slowly, and go into an approach to slow flying as your airplane approaches a tail-low attitude. Keep the airplane in this attitude for as short a time and distance as possible. You should be slow flying just before you touch the ground. Reduce the power completely when you contact the ground.

If you are making an actual short-field landing, lower the nosewheel immediately and use the brakes. For training purposes, however, hold the nosewheel off as long as possible. Land as you would in an emergency, if your brakes were not functioning.

Tips

Don't undershoot and slow fly long distances to reach the runway.

Don't use excessive speed early on the approach. This prevents a low roundout before you reach the field.

Don't drop below a safe airspeed early on the approach.

Don't use excess power in the last of the roundout. This causes the airplane to balloon and destroys the value of the procedure.

STRANGE FIELD LANDINGS

Flying above your home base you instinctively use familiar features of landscape to orient yourself. Your judgment of distance, altitude, speed, and depth are sharpened. You have probably walked into the familiar front room at home, neatly sidestepped the lamp, and continued on your way in total darkness. This same perception of familiar objects operates in every flight you make.

When away from familiar terrain, however, you may have trouble in setting the base leg at the proper place, judging the approach leg, and even regulating your speed properly.

There is a tendency toward poor depth perception when coming down from a higher altitude. All these things, while small, increase in unfamiliar surroundings.

Let down to the traffic altitude gradually and give your eyes a chance to become adjusted. Watch your speed. Because you have been flying at higher speeds you may have a tendency to fly the traffic pattern too fast and mismanage the landing.

While the local pattern is well understood, it is harder to set up the same pattern or to conform to local regulations at another field. Plan your way clearly and confidently; use your head and your eyes; take things calmly.

LOOK IT OVER BEFORE YOU DECIDE TO LAND

In landing at a strange field, come in over the field and circle once above it in the direction of traffic. Check carefully the altitude of the field and get the traffic altitude from the tower. If you cannot get specific instructions, fly the traffic pattern 1000 feet above the terrain. Obtain wind direction and velocity, line up the proper runway, visualizing exactly what you intend to do, and then drop down and enter the traffic pattern.

Get a normal base leg, establish your glide at the proper angle and airspeed, and make a power approach landing.

The power approach is important in handling the B-25. The longer you maintain the power and the closer to the ground you cut it off, the more exact is your judgment of where the airplane will land. Use the power, however, only as an aid, and not to make a low dragging approach.

After landing, call the control tower for taxiing and parking instructions.

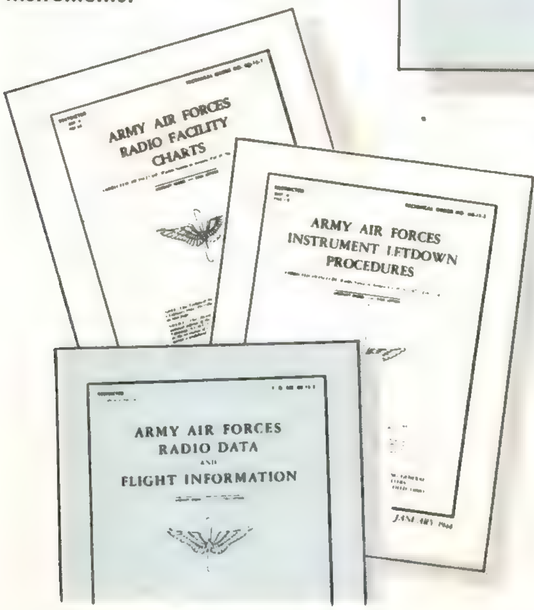
Common Errors

1. Low dragging approach with no clear conception of the field altitude. This is the result of poor planning.
2. A fast approach, the result of tenseness. Trust your plane and fly it calmly and confidently. Don't get excited.
3. Poor radio procedure, usually caused by poor tuning. Be accurate—learn procedures perfectly and use them as you have learned them. This isn't book flying; it is just plain common sense.

THESE ARE YOUR BIBLES OF INSTRUMENT FLYING

GET THEM! READ THEM! KNOW THEM!

Below are your navigational aids to instrument flight. Be sure they are in your airplane before flying cross-country on instruments.



If you want to get into trouble in a hurry just fall for that old assumption that night flying is no different from day flying. There are many important differences—learn exactly what they are and how to make allowances for them.

Night flying is similar to instrument flying. The exceptions are:

1. You can sometimes see a clearly defined horizon.

2. Lights on the ground may be grouped to form an unmistakable reference pattern.

Before you solo at night you **must** be proficient in instrument takeoffs.

Night Vision

Your vision at night is different because you are using a different part of your eye (see Physiology in Flight and AAF Memorandum 25-5). To adjust your eyes for night vision, remain in a dark room, or wear red goggles for 30 minutes before takeoff (operational conditions permitting). Don't expose your eyes to strong light—floodlights, flashlights, strong cockpit lights—after you make this adjustment. You lose your accommodation to darkness faster than you can regain it.

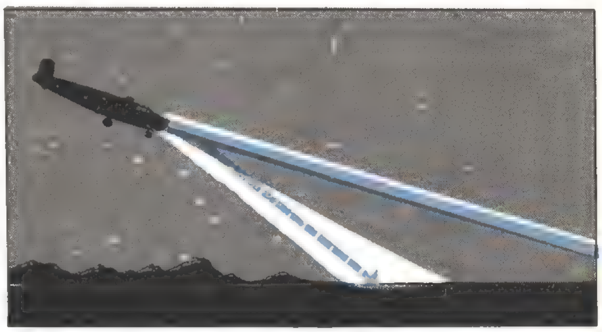
Keep all nonessential lights inside the airplane turned out. Dim all essential lights. Adjust the fluorescent lights to prevent glare. Learn to read instruments, maps, and charts rapidly—then look away.

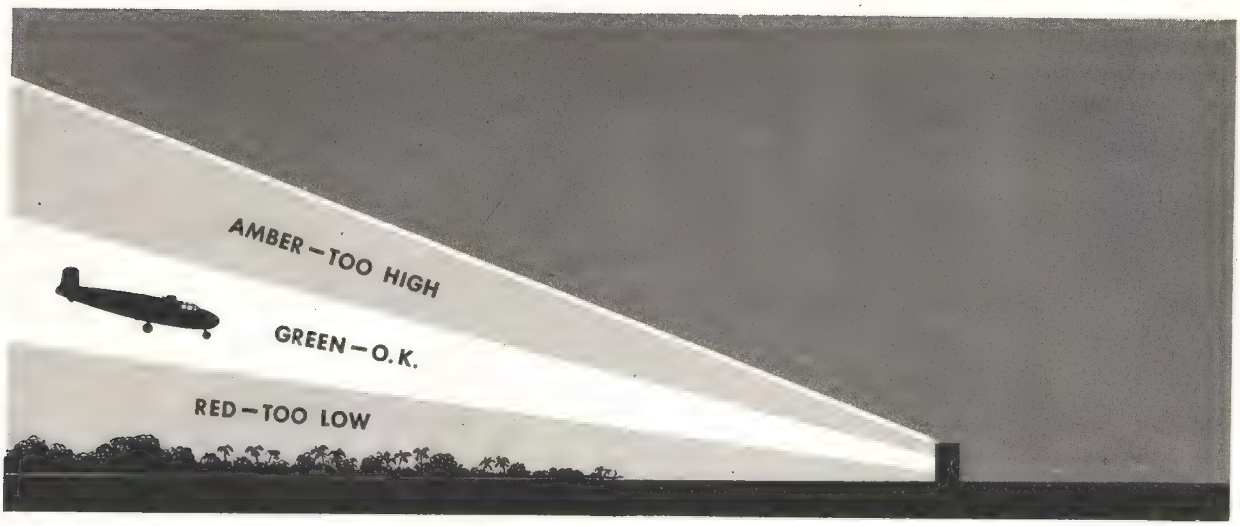
The flight instruments are your basic references at night. Check them constantly. Refer to them immediately if you lost contact orientation. Check them carefully as you taxi and before you take off.

Whenever possible use colored flashlights, preferably the standard AAF 2 and 3 color flashlights.

Floodlight or Winglight Landing

Use a normal power approach. Use a power-on roundout to slow the rate of descent. Don't turn on the wing lights too high on the approach. Don't try to sight down the wing light beams. This greatly increases the danger of flying into the ground.





Glide Path Landings

Learn the nature and location of the glide path indicator. It emits three distinct color bands of light. The landing is similar to an instrument landing. **You are supposed to come in on the green band of light.**

If the airplane approaches on the yellow band, it is too high; if on the red band, it is too low. Learn how to follow the green band—keeping as near the center of the band as possible. Make contact with the ground as soon as possible after passing the approach light. This insures clearing all obstacles on the approach path and leaves enough runway to complete the landing.

Remember—you must hold a constant rate of descent during all the approach. As you approach the glide-path indicator, and the runway lights start to level out, decrease your speed and start a slight roundout. Ease the airplane down in a tail-low attitude. Use a slight amount of power until you contact the ground, then cut the power.

Blackout Landings

Don't watch the first few lights of the marked runway in blackout landings. If you do, you may fly into the ground before you break the glide. Watch the entire line of runway lights closely. They are the main factor in your judgment of height above the ground.

Tips

Taxi carefully. Fast taxiing is a common cause of night taxi accidents.

Gain a little more altitude in the climb after takeoff, before you retract the wheels, and before you gain safe single engine speed.

Avoid excess airspeed on the approach. This causes you to land too far down the runway.

Don't make a dragging approach; there may be an unlighted obstruction in your path.

Correct for undershooting high on the approach.

Don't try power-off blackout landings when you are not **certain** of your height above the ground.

Know the location of your controls.

Always carry a flashlight.

Use landing lights **alternately** for taxiing, except in very congested areas.

Use the extension light rather than the dome light for reading maps and charts.

Check all lighting equipment and fluorescent lighting of instrument panel before leaving the ground.

Make an accurate check of your flight instruments.

Switch on the dome light if your eyes feel strained during prolonged instrument flight at night. This creates the illusion of flying under a hood and relieves strain.

"You just gotta stay in there." Thus returning combat pilots pass on to you the most important thing they learned in the battle zones.

"You just don't come back from a mission if you straggle from a formation. Even if you are hit and hurt badly, if the plane can stay in the air, stay in formation."

This is not an obsession; it is a lesson so well learned that it is instinct. Combat pilots know, as no other men on earth can know, that mutual protection alone makes possible the operations over enemy territory today.

As a trainee pilot it is a lesson you can learn from the experiences of other men. Prepare yourself for the job to come by mastering the elements of formation flying.

Why Fly in Formation?

Bombardment units fly in formation for many reasons, and mutual defense is only one of them. Other reasons are:

1. Concentrate the power of the attack.
2. Concentrate the power of the defense.
3. Maintain the element of surprise in attack.
4. Observation against surprise attack.
5. Unity of command.
6. Maneuverability for attack and defense.
7. Control of navigation.

The basic formation procedures you have learned remain the same. The difference in tactical training is slight; it is primarily in the accuracy of your technique, and the limitations of your airplane.

The B-25 is easy to fly in formation. You need good instruction and plenty of practice, however, to become competent in the technique.

Your main problem is learning the difference between handling the B-25 and a light training plane. Weight and momentum are your chief concerns.

The B-25 does not respond instantly to changes in power settings.

You have more than 26,000 lb. to control, and the momentum of this weight must be overcome before the plane responds to changes in power. When applying power, give the plane a chance to respond. Don't be a throttle juggler—it is not necessary, and you cannot fly good formation by blasting the power on and then cutting it off. Tease your plane into its position by small, accurate corrections. You can fly accurate, well-controlled formation and seldom need a great change in power setting.

Learn to anticipate. This is the hardest part of formation flying in the B-25. The ideal formation is one in which each man so anticipates his power needs that he never has to make any but the slightest corrections in his power settings.

Tactical formation places a high premium on a pilot's ability to move accurately from one type of formation to another. You must be able to move quickly from a relatively loose route formation to a tight defensive formation. If you are in proper position above and well up on the lead plane, you can close accurately and quickly by nosing down, thus converting altitude to the speed required.

You may fly in a formation of hundreds of airplanes, but these huge formations break down into the familiar 3-plane combinations. Learn these fundamentals well and you will feel at home and be in position in any formation.

Air Discipline

A formation in the air is no place for a difference of opinion. You are in a formation to enable the formation leader to exercise his right of command.

He is the boss of the formation as a captain is boss of his ship at sea; there is no question of his orders and no recourse. Once you have landed, you—like a sailor—can take your complaint to a higher authority.

In the air—Obey.

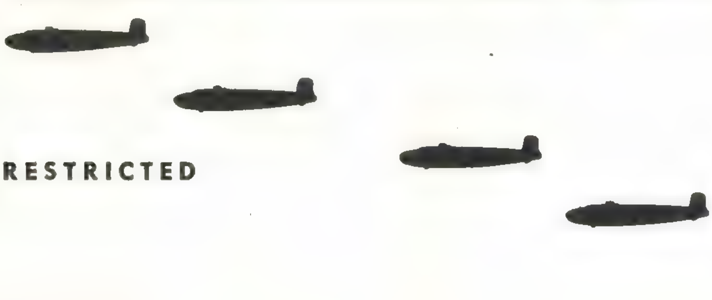
Types of Formations

There are many types of formations; for simplicity, the three basic groupings are sufficient to give you the primary elements of all formations.

These formations are illustrated as squadron formations to allow you to see their integration into larger groups.

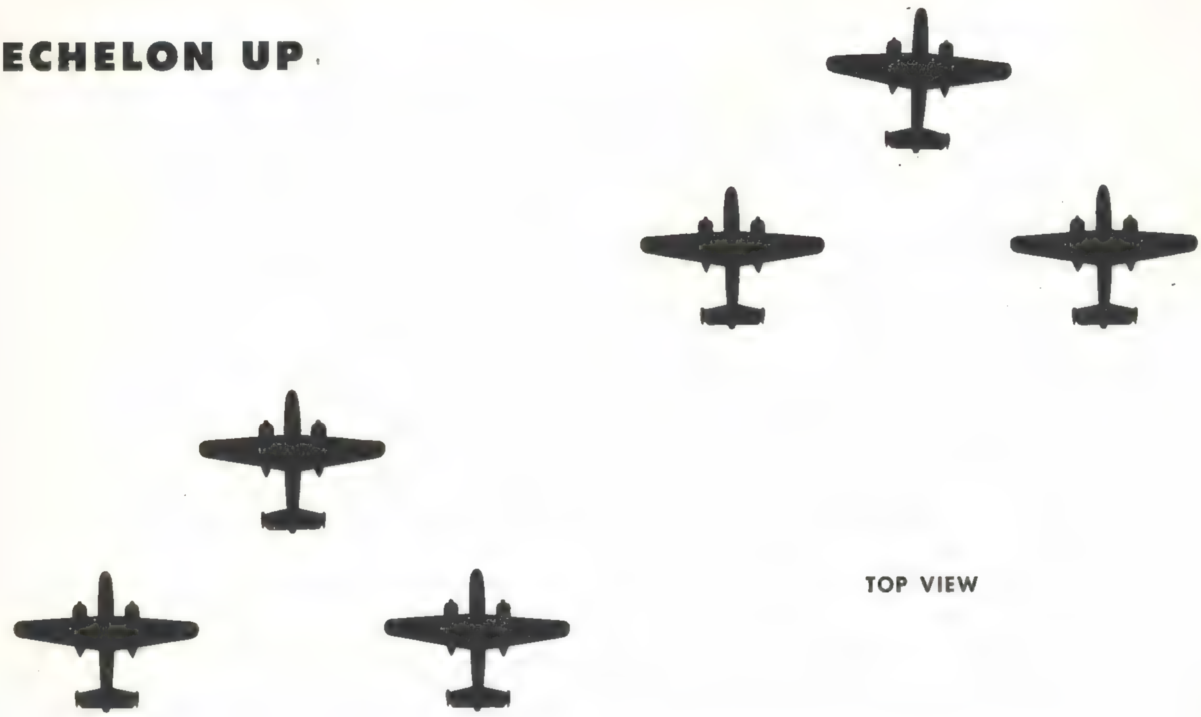
JAVELIN DOWN

TOP VIEW



SIDE VIEW

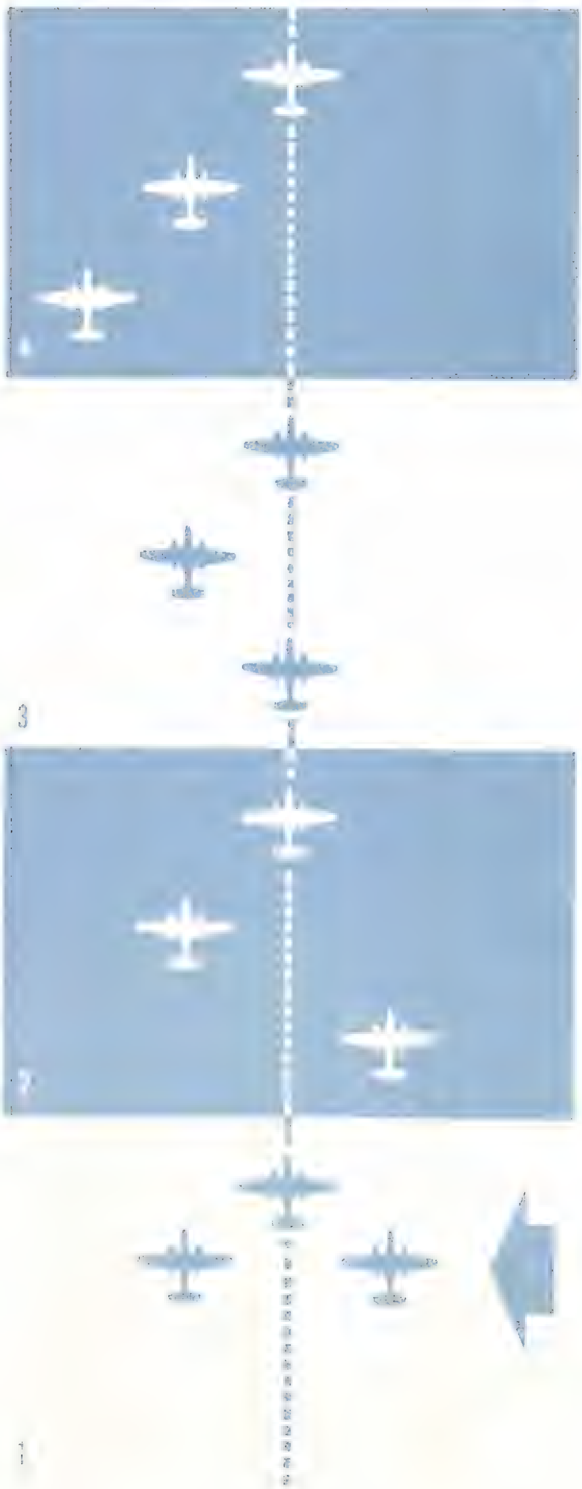
ECHELON UP



TOP VIEW

REAR VIEW

CHANGING FROM VEE TO ECHELON



The echelon is a convenient arrangement from which individual airplanes can peel-off to land. It is formed from a basic Vee element, in the direction opposite from which the peel-off will be made.

Signals

Standard signalling procedure for the Vee is one dip of the leader's wing in the direction he wishes you to form. To form larger groups, echelons of elements, etc., use local signalling procedure. These signals must be part of the pre-flight briefing.

To Change Position

The stationary wingman, on the leader's signal, moves to a position level with the leader and 30° to the rear. Hold clearances between airplanes to conform to AAF regulations. The moving wingman drops back to get lateral clearance from the No. 2 man. Drop down far enough to avoid prop wash and cross under the stationary wingman. Assume the same position in relation to the No. 2 man that he is holding on the leader.

Peel-off

You can make a peel-off from echelon formation up, down, or out. Use a pre-arranged time interval for peel-off by individual airplanes. Hold a constant degree of bank through the entire 180° turn from the peel-off. This puts the echelon in trail and properly spaced for landing when they arrive on the downwind leg. This is precision flying—make it that. Don't drop too far back. Don't bank too steeply. Either error separates the formation.

KEEP ALL AIRPLANES IN YOUR FIELD OF VISION AS YOU CHANGE POSITION

Accident records tell a depressing story of pilot after pilot pulling into another plane after allowing it to get into a blind spot.

Takeoff

A time interval is set between takeoffs for each plane; on the basis of this time interval, the formation leader flies straight out from the end of the runway at a predetermined rate of climb and a set airspeed. When the time interval shows that his immediate flight is in the air, he starts a constant-rate turn, allowing the rear planes to turn inside him and close in to pick up position.

Each plane takes an alternate side of the runway at takeoff to avoid the prop wash of the preceding plane.

Warning—Watch wind direction closely to determine where you will encounter the heaviest prop wash, and try to fly above or below it at that point.

Keep your nose inside the nose of the lead plane. You will delay the entire joining procedure if you turn with the lead plane instead of inside him.

As you approach the lead plane slow down your rate of closure. Pull out to one side and slightly behind the lead plane and slowly work your way into position. Don't pump the throttles.—You will never learn to fly formation with a pair of throttles . . . you can only learn by using your head. Anticipate—think—and don't try to be a "hot-pilot."

Landings

Procedure for landing large formations is specified by local regulations. You can peel-off elements first, then peel-off individually from the elements. Regardless of the method used, if you do a good job of precision flying, you land at approximately the same time interval used for the peel-off. Always land in the first third of the runway.

To land in formation you must land accurately at varying distances on the runway. Land on the side away from the plane ahead of you, and give the man behind you a little room to get down. Don't blast your throttles on the approach. You only create unnecessary prop wash. Plan your landing to get in without increasing power.

Don't be afraid to go around if you mess up a formation landing. **Remember, there is a man coming in right behind you.** If you can't land accurately, go around.

Watch the plane ahead of you. If you see him make a low, dragging approach, you will eat a lot of his prop wash as you land. Try to plan your landing to come in over his prop wash, and let down to the runway where his power has been cut, thereby missing the worst turbulence.

Leading a Formation

Leading a formation requires accurate, precise flying and excellent judgment. It is similar to instrument flying. A definite planned procedure is the secret of leading a formation properly.

Remember—your wingmen trust you implicitly for leadership and direction. Neither you, they, nor anyone else will trust a leader who bounces around like a Yo-Yo. Make each maneuver smooth and slow enough so that your poorest wingman can follow you without difficulty.

Make your signals distinct, but not violent. Remember that the size of the formation following you governs the arc of turn. If you pour on the coal and turn tight you play crack-the-whip with the man on the tail of the formation. Tomorrow he may be the guy whose gunners could save your neck if he was in position.

Fly at reduced power. Your wingmen must have a margin of power available to maintain position.

Follow the instructions given on the ground. Many combat reports show that formation leaders have caused casualties by ignoring the planned attack to try a makeshift at the last moment.

Remember the size of your formation.

Fly accurately.

Plan your work well in advance.

Fly at reduced power—compact defensive power is more potent than a little extra speed.

Use the best judgment you are able to exercise.

Tips for a Wingman

Trust your leader. Stay in formation.

These two simple things will do more than anything else to bring you home safely from the toughest missions. If you disagree with the formation leader, wait until you are on the ground to say so.

Watch the lead plane constantly.

Make power changes smoothly, waiting for the plane's reaction.

Keep your head out of the cockpit. Train your copilot or engineer to make rpm adjustments to compensate for your changing throttle settings. Don't change them constantly, but stay out of the detonation range.

When changing position, keep all other planes in your field of vision.

Coordinate the controls. You don't have to kick your plane around; fly it through the necessary corrections.

Be ready in advance of takeoff time. Don't be so late that you have no time for a good pretakeoff check of your plane.

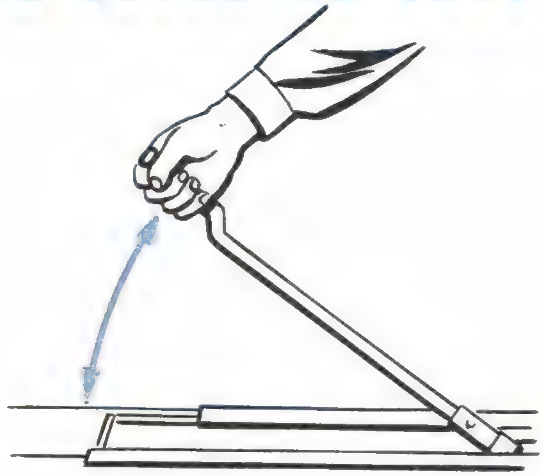
Caution

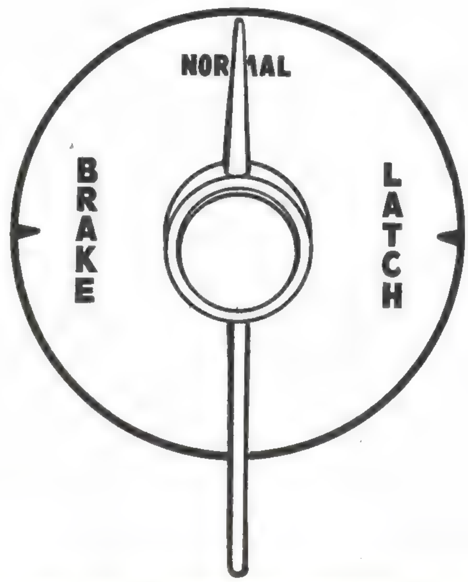
When operating on Grade 91 fuel, for additional safety, formation leaders should reduce manifold pressure 2" Hg. and wingmen should increase rpm settings by 100 rpm.

FORMATION ERRORS

Overshooting the lead plane.
Lack of anticipation.
Throttle pumping.
Overcontrolling the aileron.
Poor joining—closing too fast, carelessness.

AUXILIARY HYDRAULIC PUMP AND EMERGENCY HYDRAULIC SELECTOR VALVE





The auxiliary hydraulic pump is a double-action hand pump for use as a source of pressure if the main hydraulic system fails.

It is between the pilot's and copilot's seats and either man uses it.

A selector valve, directly behind the hand pump on the floor, distributes the pressure from the hand pump.

The selector valve has three positions, "NORMAL," "BRAKE," and "LATCH." In "NORMAL" position the pressure from the hand pump is distributed through the normal hydraulic lines. In "BRAKE" position the pressure goes directly to the brake accumulator and then to the brakes. In "LATCH" position the pressure goes directly to the landing gear down-latch pins.

Use this auxiliary source of hydraulic pressure to make all normal hydraulic actions when the engine driven pumps fail.

You can use it to aid or replace the engine-driven pumps.

Caution

When only one engine-driven hydraulic pump is operating it takes longer to lower the landing gear. Have your engineer-gunner or copilot operate the hand pump to aid in lowering the landing gear.

Note

If down-position latchpins of the main landing gear do not engage, turn emergency hydraulic selector valve to "LATCH." Operate the hand pump until position indicator shows main landing gear latchpins in place.

Use this procedure regardless of whether you have employed the main or emergency hydraulic systems for lowering the landing gear.

The yellow flags which show up on the position indicator will always warn you if the latchpins are not engaged.

Never pump the latchpins into place unless the main wheels are full down.

EMERGENCY HYDRAULIC WHEEL LOWERING SYSTEM

The B-25 has an emergency hydraulic wheel lowering system to provide power if the main hydraulic wheel lowering system fails. The system provides for simultaneous lowering of main landing gear and nose gear.

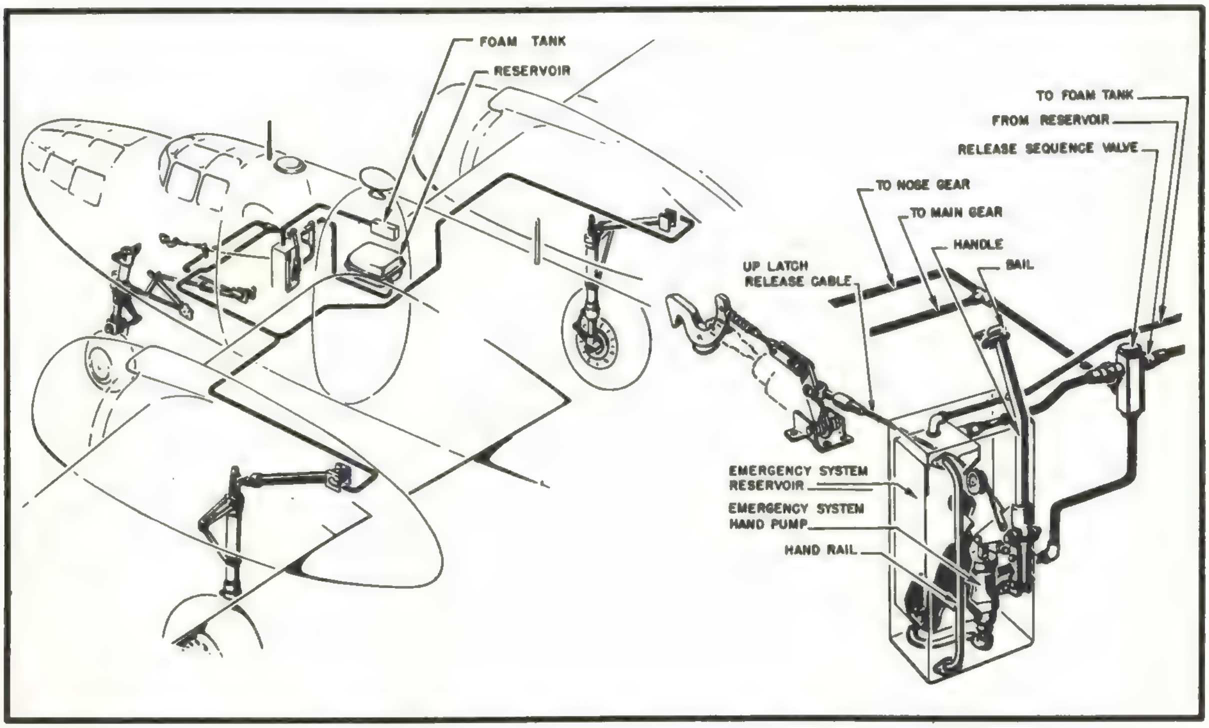
The system consists of an emergency hand pump and a hydraulic fluid reservoir, both in the navigator's compartment. The complete system incorporates automatic valves to regulate normal and emergency flow of fluid to the operating struts, a nosegear up-lock release cable connecting the hand pump handle and the up-lock latch, and fluid transmission lines.

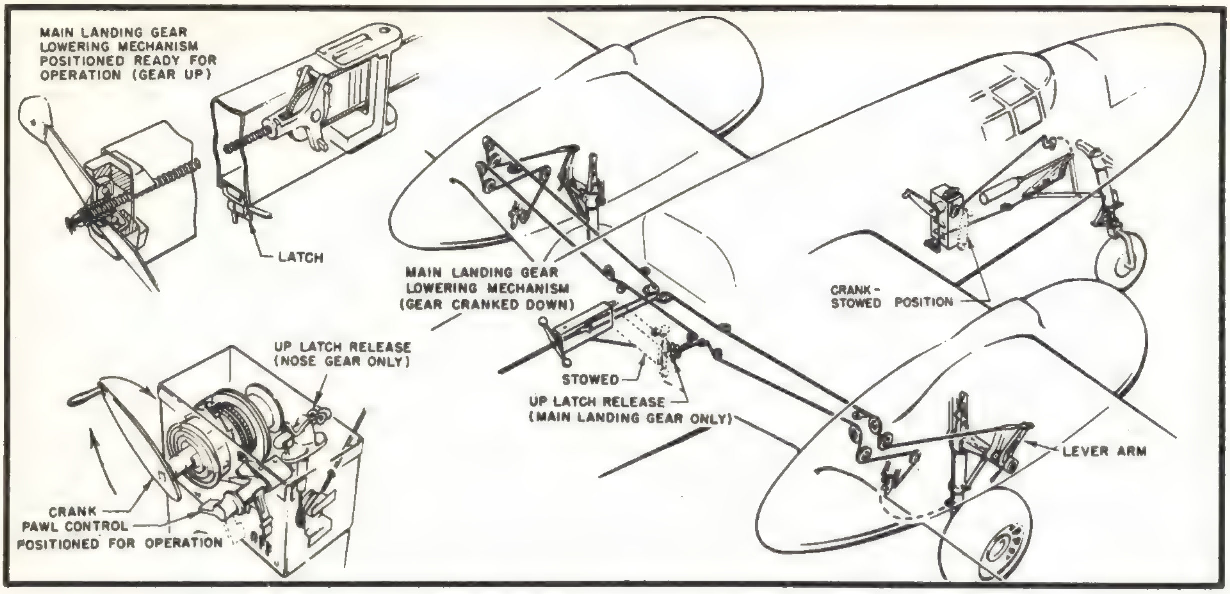
The emergency reservoir fills automatically when the main reservoir is filled, and the fluid is available for the emergency lowering of the landing gear even if the main hydraulic system fluid is completely lost.

Operation

If the hydraulic system fails completely, take the following steps:

1. Return to the home base if possible. Report your trouble briefly to the tower.
2. Climb to an altitude of at least 5000 feet above the surrounding terrain.
3. Reduce your airspeed below 150 mph.
4. Place landing gear control handle in pilot's compartment "DOWN."
5. Operate emergency hand pump one full stroke to release nose gear up-lock. Check landing gear indicator to see whether nose gear is partially extended. If not, give the pump handle another full stroke.
6. Operate the hand pump until gear is down and locked. Employ your normal checks to insure that gear is actually down and locked.





7. Return pump handle to forward position and safety it.

Some earlier models of the B-25 have mechanical emergency wheel lowering controls. In these models, you lower the main landing gear and the nose gear separately. The controls consist of screw jacks and a series of cables which operate directly on the wheels.

In the event of **complete** failure of your landing gear hydraulic system, operate the emergency controls as follows:

1. Establish effective interphone communication between the crew member operating the mechanism and the pilot.
2. Return to the home base if possible. Report your trouble to the tower.
3. Climb to an altitude of at least 5000 feet above the surrounding terrain.
4. Reduce the airspeed below 150 mph (120-130 mph recommended.)
5. Place landing gear control handle in pilot's compartment "DOWN."
6. Swing screw jack in radio compartment to the operating position.
7. Pull up-latch release and check to see that the main gear has released.
8. Operate the screw jack (clockwise) to lower the gear.
9. Use normal landing gear check to see that the gear is down and locked.
10. Release the tension slightly on the screw jack after the gear is down and locked.

Warning: Don't return this system to a stowed position until the plane is safely on the ground, with the landing gear locked to prevent its folding up.

You must stow this system before the wheels can again be operated hydraulically.

Nosewheel

The lowering device for the nosewheel is in the navigator's compartment, on the step into the pilot's compartment.

To operate:

1. Pull nose gear release.
2. Check to see that the gear has released.
3. Turn the nosewheel pawl "ON."
4. Place crank on shaft, turn clockwise to lower.
5. Check locked position normally after the gear is full down.

Warning: The nosewheel lowering cable operates every time the nosewheel is raised or lowered. It is engaged by the pawl to lower the wheels. If the pawl is accidently turned to "ON" the hydraulic system will tear the nosewheel cable out of the plane.

This pawl must be left "ON" after it is used until the plane is on the ground and braced against mishap.

WING FLAP EMERGENCY LOWERING SYSTEM

In the event of **complete** failure of the main hydraulic system, an emergency mechanical flap lowering mechanism is available. It is important to remember to use the emergency mechanism only when the hydraulic system failure is **complete**, as the two systems oppose each other. Use of the emergency system while hydraulic pressure is still available will seriously damage the mechanical system.

The emergency mechanism is in the radio compartment. Be sure the interphone communication between the crew member operating the mechanism and the pilot is 100% effective.

Before entering the traffic pattern it is advisable to lower partial flaps. This enables you to get desired amount of flaps earlier on the final approach.

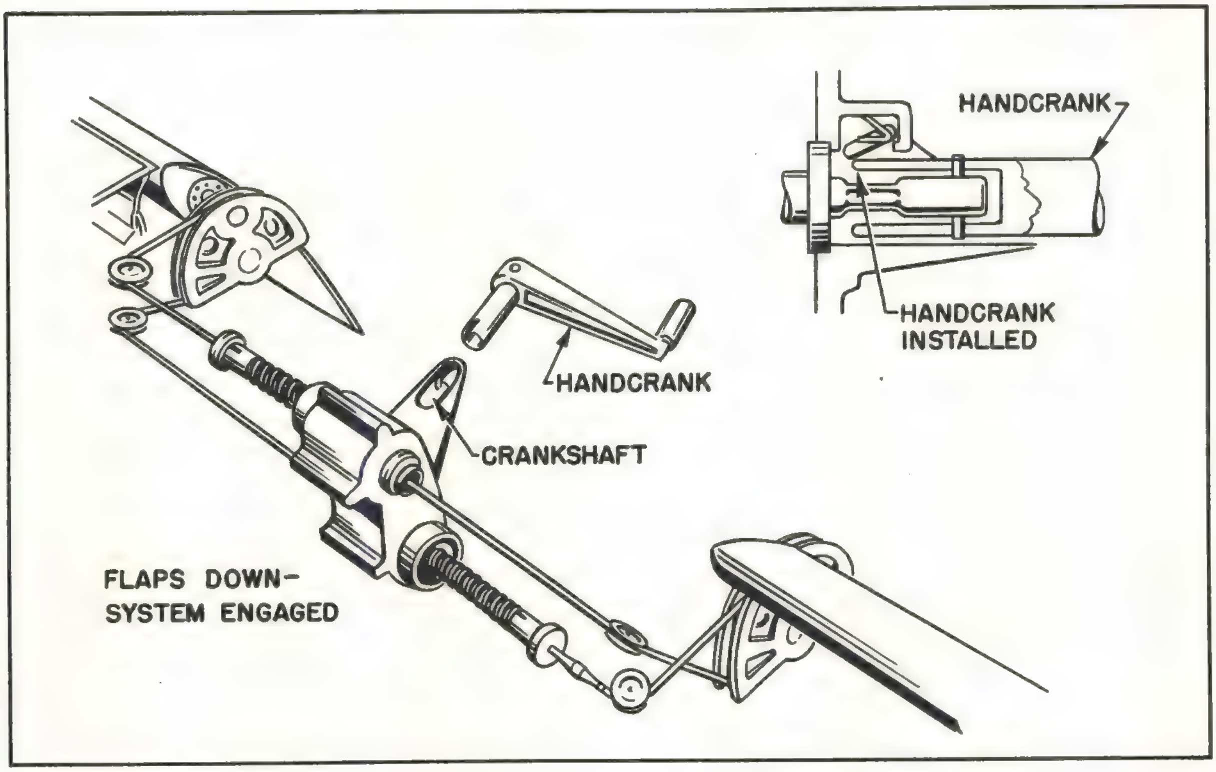
Operation

1. Reduce airspeed below 150 mph.
2. Move pilot's flap control "DOWN."
3. Remove hand crank from stowage position on forward wall of radio compartment and engage it with the shaft.
4. Rotate crank clockwise until you obtain the desired amount of flaps—14 turns will give you half flaps; 27 turns, full flaps.
5. To lock flaps in position, remove the crank.

Note: If go-around is necessary, turn crank counterclockwise to full stop position. (This operation does not raise the flaps, but releases the pressure on them and the force of the slipstream raises them.)

Warning

Before operating the flaps hydraulically again, be sure that your mechanical system is fully disengaged. To disengage, rotate crank counterclockwise until checked. Remove crank and return to its stowage position.



EMERGENCY OPERATION OF BOMB BAY DOORS

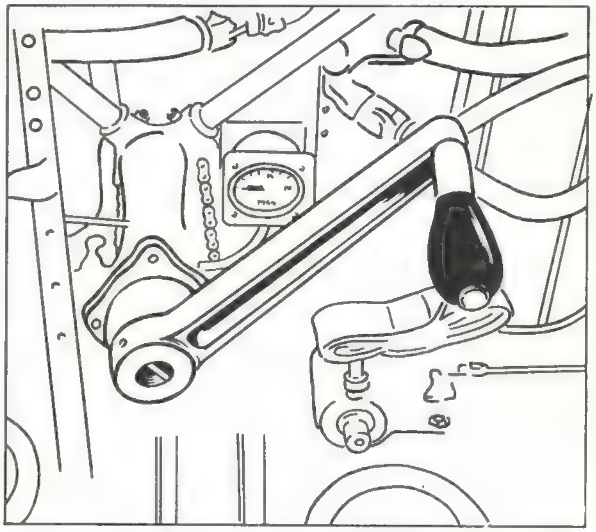
Mechanical

The bomb bay doors will automatically open approximately ⅔ of the way in the event of a hydraulic failure.

Use the mechanical system only when hydraulic pressure fails.

1. Move bombardier's control handle to "OPEN." The doors are open and the racks are locked in this position.
2. Install crank on the shaft in the rear of the navigator's compartment, just under the navigator's table. The crank is stowed on the lower right longeron opposite the crank shaft.
3. Turn the crank clockwise to open the doors. Reverse to close them.
4. Thread strap (secured to crank handle) through the down strap on the floor.

Note: The doors are normally held open and closed by hydraulic pressure. The doors will stay open unsecured but must be safetied in the closed position.



EMERGENCY BOMB BAY DOOR CRANK

EMERGENCY SALVO RELEASE

When your hydraulic system is in operation you can salvo all of your bomb load, both internal and external, by moving the bomb control to the "SALVO" position.

All bombs are dropped safe when salvoed, unless you have an arming control in use on your plane. In that case you can salvo them either armed or safe.

Your bomb bay droppable tank is suspended on bomb shackles in the bomb bay; the pilot and bombardier both have control of these racks and may salvo both bombs and bomb bay tank.

When the droppable bomb bay tank is salvoed the remaining fuel in fuselage tanks cannot be used. The fuselage tanks are connected to the droppable tank and feed their fuel into this tank then to the front main cells.

Late airplanes have a fuel cell installed in the radio operator's compartment. When this tank is installed it also passes fuel into the droppable bomb bay tank or into the fixed tank in the top of the bomb bay before it is transferred to the front main cells.

To Operate

1. Push the bombardier's control handle to "SALVO."
2. Pull the pilot's emergency salvo release; this will automatically open the bomb bay doors and salvo your load.

Now to return the system to normal operation.

If the bombardier's control has been used, simply move the control handle to "CLOSED."

If the pilot's emergency release has been used:

1. Move the bombardier's control handle to "SALVO"; this recocks pilot's emergency release.
2. Move control to "DOORS CLOSED."

If your plane has an auxiliary control for torpedo work, you may push down and pull out this control, which is on the right side of the

pilot's control pedestal. This enables you to close the doors from the pilot's compartment.

If you use this control, however, you must re-open the doors with it before you can regain control with the bombardier's control handle.

To salvo the torpedo you must:

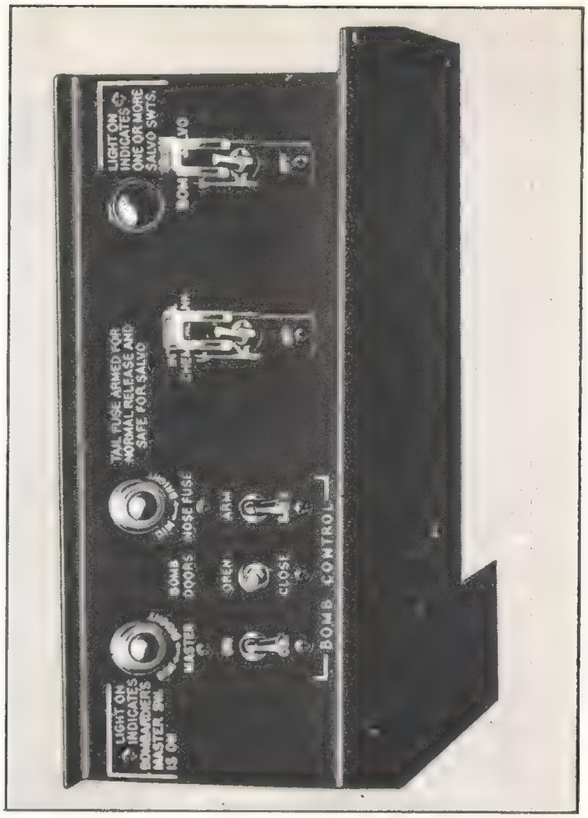
1. Open the bomb bay doors with the auxiliary control.
2. Pull the emergency salvo release (this also jettisons the wing bombs.)

Late airplanes have electrical salvo switches. They operate exactly as the manual controls do if the hydraulic system is in operation. To operate simply move either switch to "SALVO."

Warning

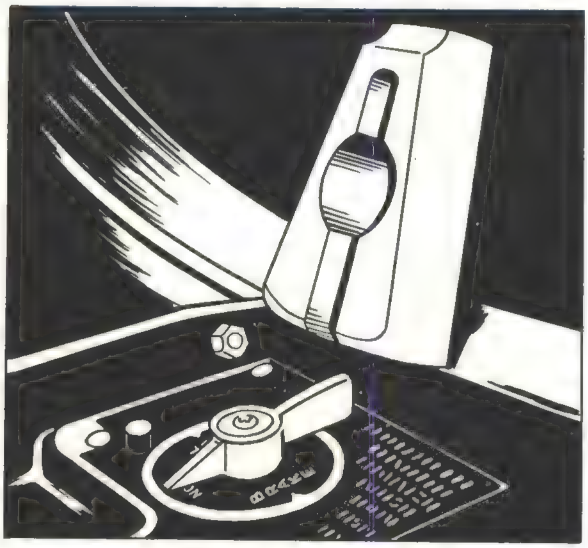
On the torpedo only it is necessary to open bomb bay doors to use the emergency salvo release.

Note: On some B-25J and B-25H airplanes the bombing controls are electrical. In the event of electrical failure you cannot salvo the bombs or bomb bay tank.



PILOT'S BOMB CONTROL PANEL

EMERGENCY OPERATION—HYDRAULIC BRAKE



EMERGENCY HYDRAULIC SELECTOR VALVE

Before landing, if there is less than 1000 lb. pressure indicated on the brake system pressure gage:

1. Turn hydraulic selector valve to "BRAKE."
2. Operate the hand pump until indicator shows 1000 lb. sq. in. minimum and no more than 1450 lb. sq. in.
3. Operate continuously while landing and taxiing as the initial pressure in the accumulator is insufficient for normal landing.
4. If, on landing, you cannot maintain sufficient pressure, use the emergency air brake system.
5. If you cannot build up 600 lb. pressure in the accumulator, pick a field with at least a one-mile runway, land and use the air brake system.

Always make a short-field landing when your brake pressure is low.

EMERGENCY OPERATION—AIR BRAKES

Use this Air Brake System only in extreme emergencies.

Use it when normal hydraulic system has failed and you cannot develop sufficient pressure with your auxiliary hydraulic hand pump.

When you are sure you must use the air brake system, choose the field with the largest runways within range of your airplane. The runway should be at least one mile long for a safe landing. Make a short-field landing.

Dissipate all the speed you can safely lose before using your air brake, but don't wait until you are out of runway!

You cannot use these brakes selectively. Be ready to counteract any uneven braking action with the throttles.

Operation

1. Pull up sharply on the air brake handle to break the safety wire.
2. Lower the handle immediately. Lower it by hand, as the handle is spring-loaded and will be pulled back past neutral if it is allowed to snap down.

The air pressure is applied to the brakes at the extreme top of the brake handle's travel, and released at the extreme bottom of the travel. In neutral, the air pressure is locked in the brakes and air bottle.

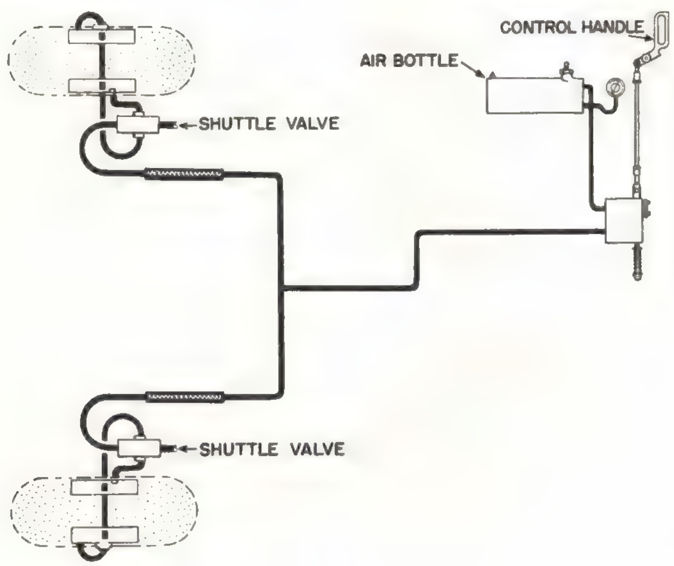
3. Apply braking action in a series of quick, sharp applications. If you apply the brakes continuously for two to three seconds most of the pressure will be transferred to the brake drums and the brakes may lock.
4. To release the brakes, move the brake handle all the way down. It will release pressure in the brakes only at the end of its travel.
5. After you accomplish one complete braking action and the plane stops, there should be a small residue of air still in the emergency air brake bottle. You can use brakes a second time only at a greatly reduced power.
6. You must depend only on the original braking actions and should, on coming to a stop, call the tower and have the plane towed in. Any attempt to taxi with the limited braking action available is extremely dangerous.

Warning

Placing handle in neutral position must be done by hand; the spring load on the handle will snap it into release position and exhaust the air pressure.

Chock wheels before brakes are released.

Bleed hydraulic brake system after using the air brake system.



EMERGENCY HYDRAULIC BRAKE SYSTEM

Late Airplanes

An emergency hydraulic brake system replaces the air brake system used on early airplanes. It has two advantages over the old system: it gets its supply of fluid and pressure from the regular hydraulic system, and it provides selective braking action for each wheel.

Use this system as you would the air brake system when the normal brake system fails. Test these brakes regularly as you taxi during normal operation. A separate accumulator fills automatically from the regular hydraulic system and a controllable check valve holds the pressure in the emergency brake system even though the entire fluid supply of the regular hydraulic system is completely lost.

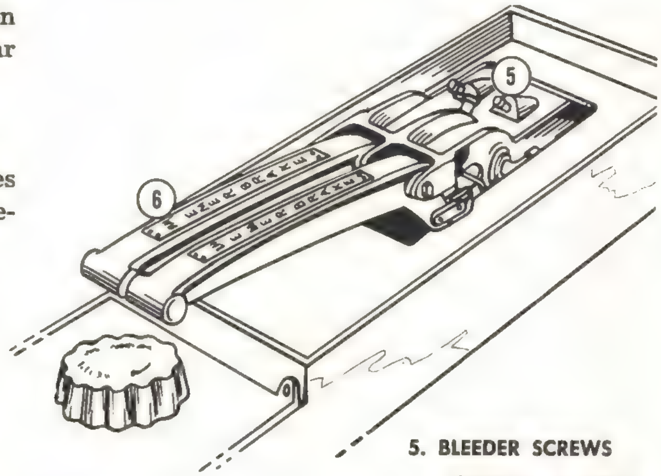
Operation

Pull up on either or both control handles until the desired braking action is obtained. Release the handles, a ratchet attachment on the handles holds them in place.

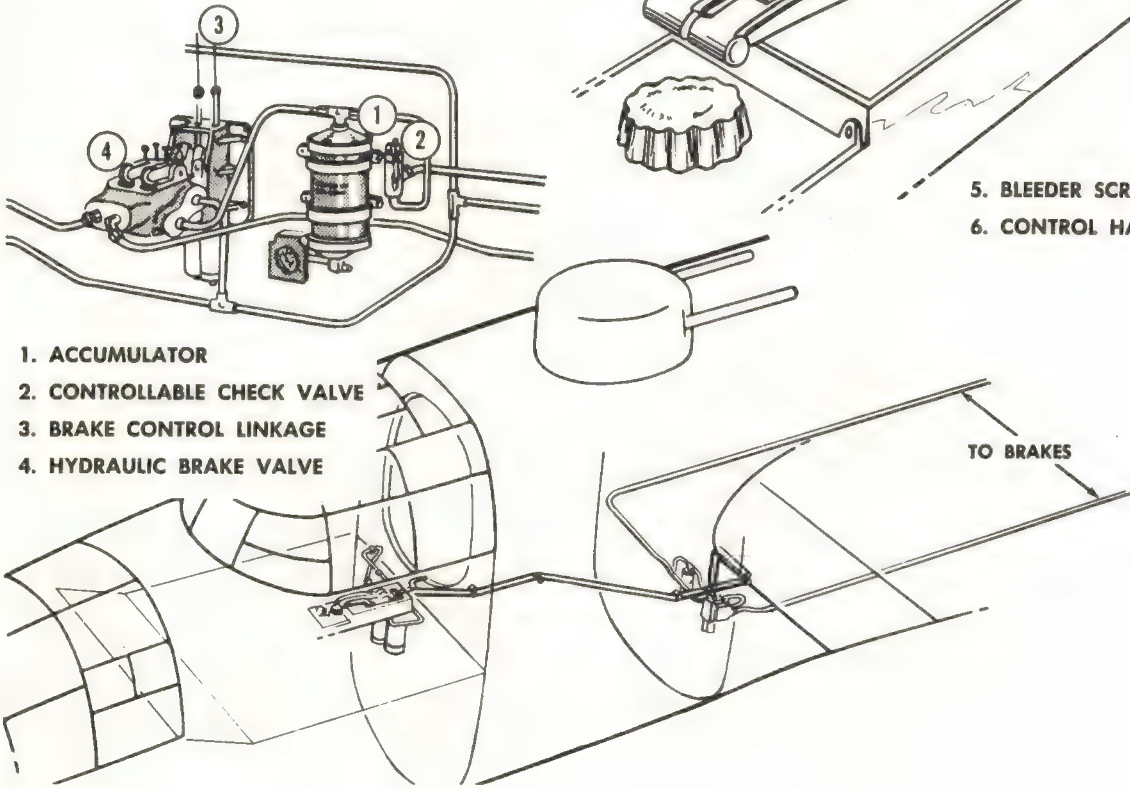
To get selective control over either wheel simply use one brake or the other as desired.

To release the brakes push the control handles down.

Adequate pressure is available for four applications of the brakes. Further braking action is dependent on the pressure remaining in the accumulator.



5. BLEEDER SCREWS
6. CONTROL HANDLES

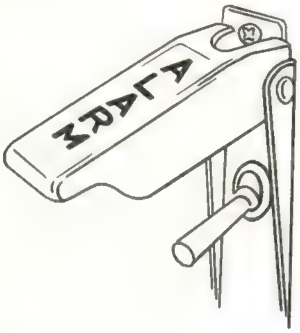


1. ACCUMULATOR
2. CONTROLLABLE CHECK VALVE
3. BRAKE CONTROL LINKAGE
4. HYDRAULIC BRAKE VALVE

Miscellaneous Emergency Equipment

ALARM BELLS

The alarm bells are located at all crew stations. A switch on the lower left section of the pilot's switch panel controls them.



LIFE RAFT

A life raft equipped with a CO_2 cylinder for instantaneous inflation is stowed in the upper forward left corner of the radio compartment. For proper use, see ditching.

LIFE PRESERVERS

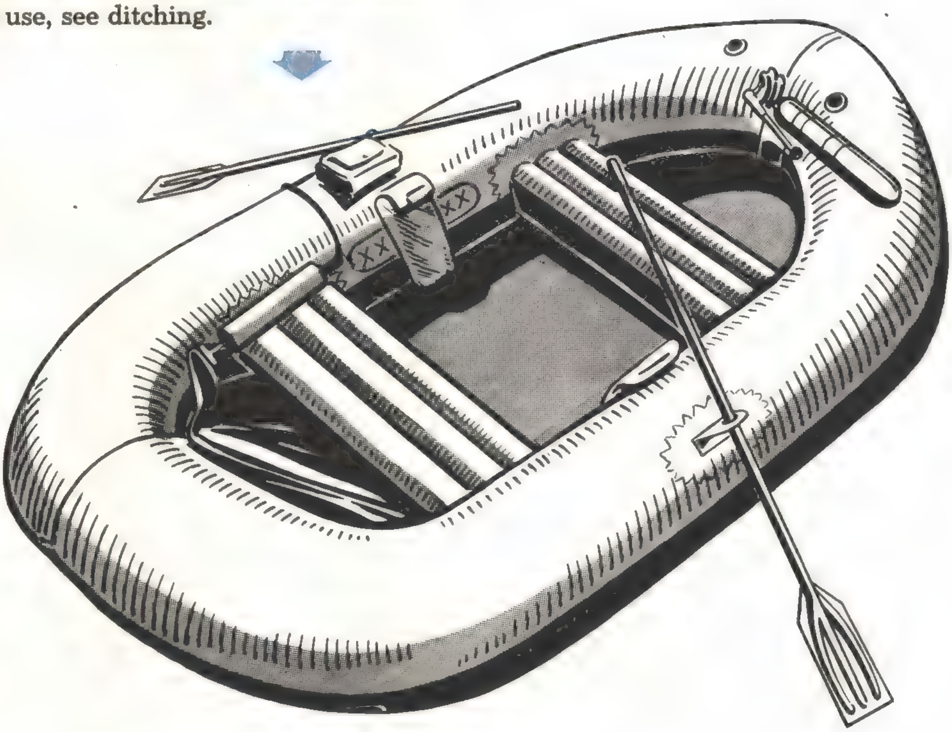
The back cushions on the pilot's and copilot's seats are filled with kapok and will serve as life preservers.

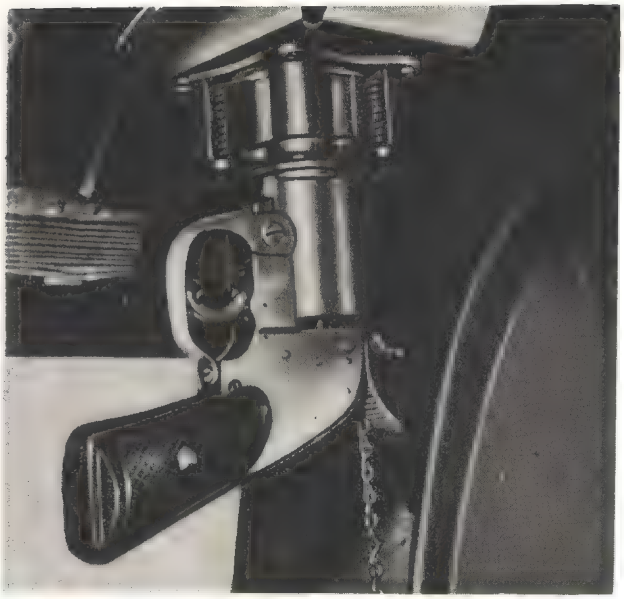
EMERGENCY FUEL PUMP

In late-series airplanes there is an emergency fuel transfer hand pump on the floor of the navigator's compartment. If the electric fuel system fails, you can transfer fuel from the bomb bay tanks to the wing tanks with this pump.

PYROTECHNIC SIGNAL PISTOL

On later planes, an M-8 type pyrotechnic pistol is stowed in a canvas holster in the navigator's compartment as loose equipment.





Warning

Don't load this pistol except when it has been placed in the mount provided in the upper left corner of the navigator's compartment.

RADIO DEMOLITION SWITCH

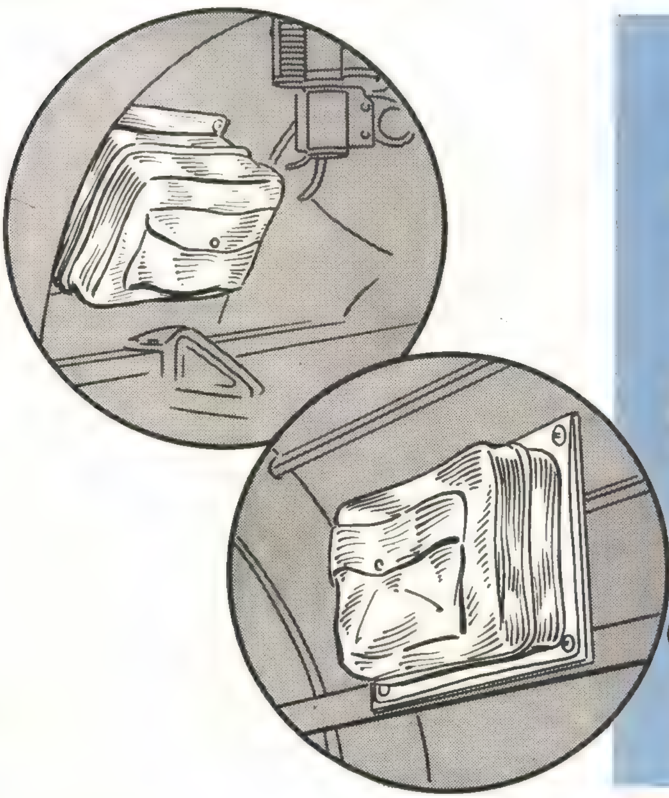
On later airplanes, a switch controlling the charge for demolishing the identification radio in an emergency is on the right instrument subpanel. Depress both buttons simultaneously to set off the charge.

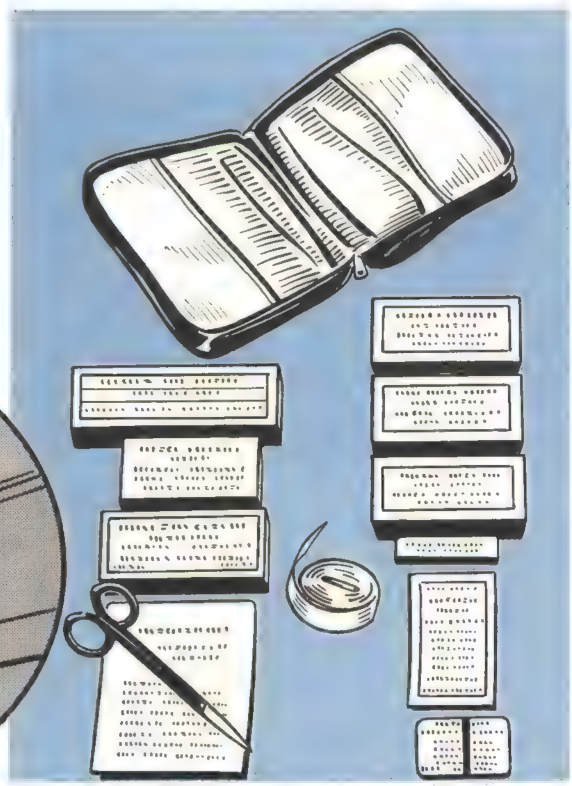
HAND AX

There is a hand ax on the right side of the fuselage in the radio operator's compartment.

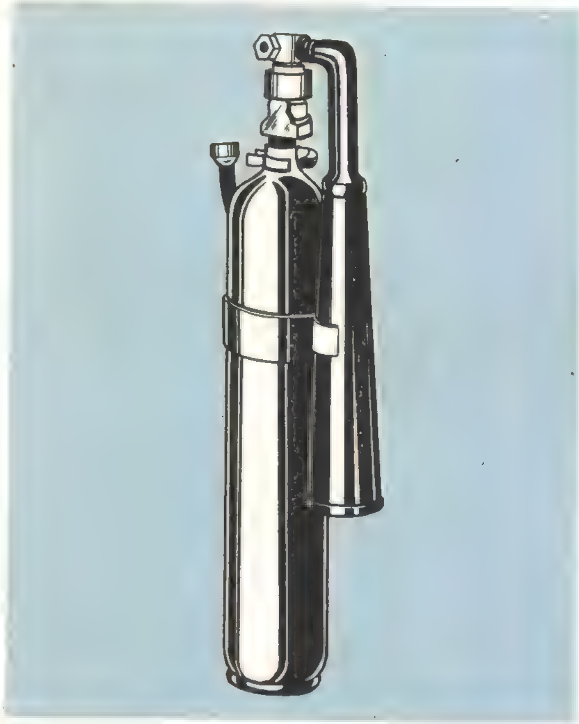
FIRST-AID KITS

Two first-aid kits are provided, one on the left side of the navigator's compartment, the other on the right side of the radio compartment. The number of kits is often increased when the ship engages in tactical operation.





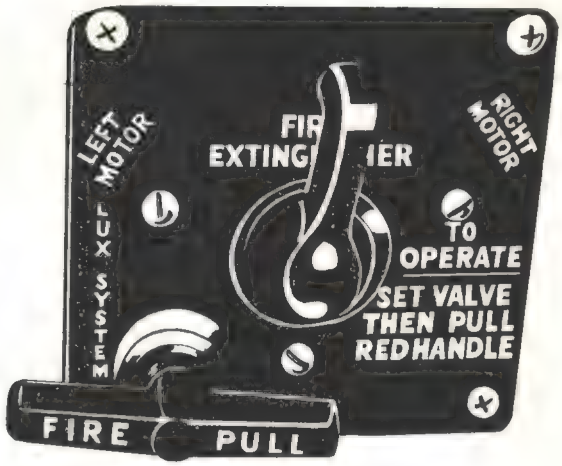
FIRE EXTINGUISHERS

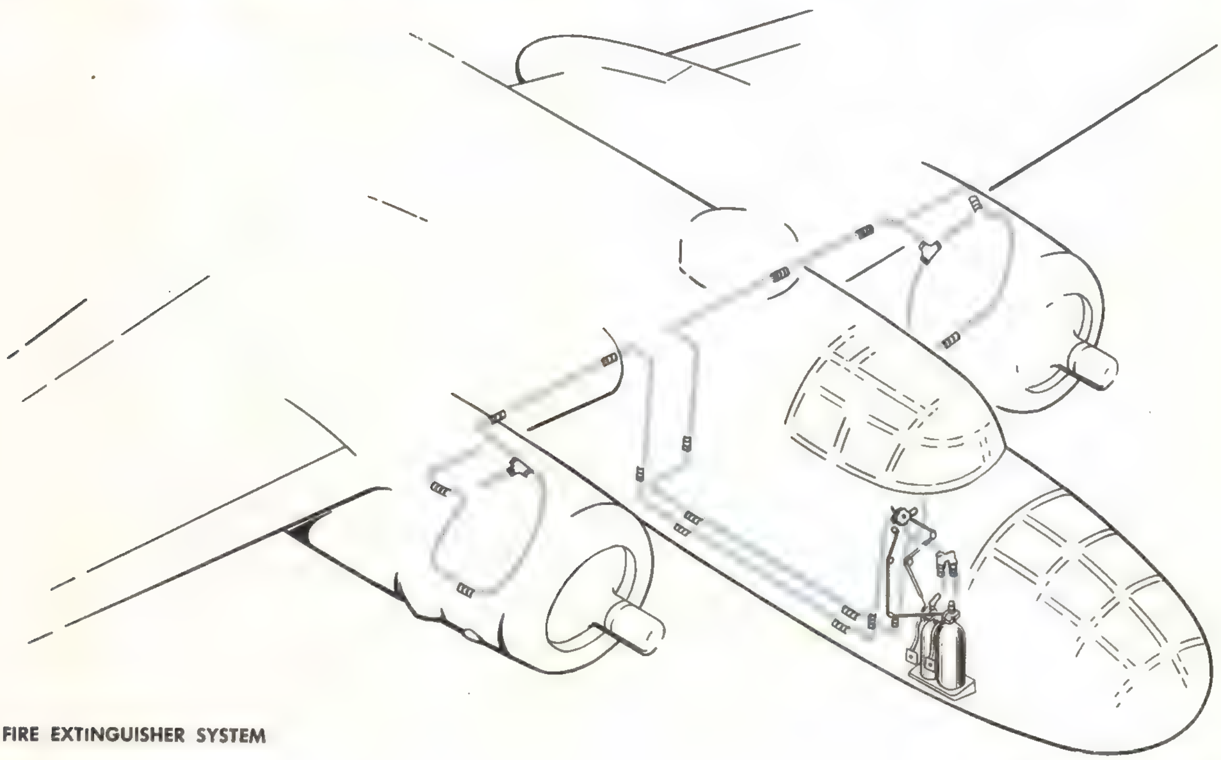


FUSELAGE FIRE EXTINGUISHER

Carbon dioxide fire extinguishers are at the right side of the navigator's compartment and at the right side of the radio operator's compartment.

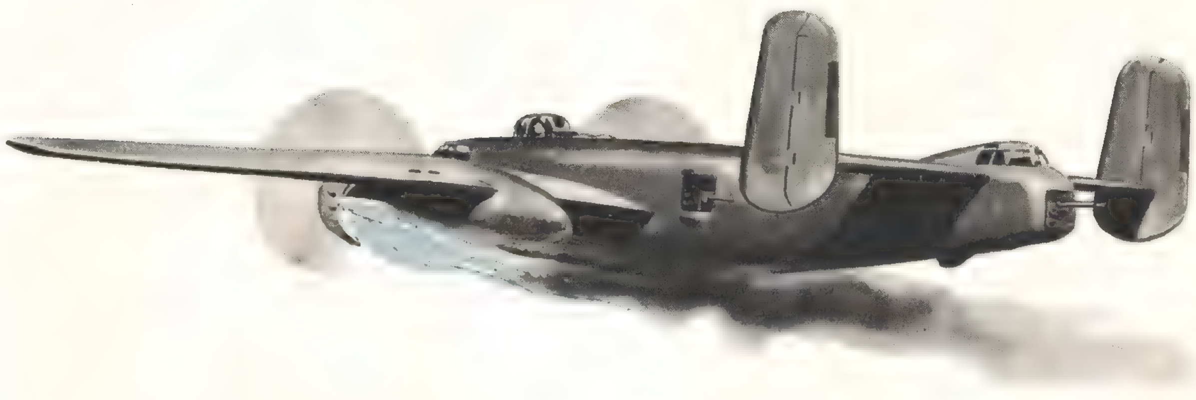
There is an engine fire extinguisher system for both engines. It is controllable from the copilot's station. A safety fuse for indicating a premature discharge is on the right side of the fuselage above the nosewheel.





FIRE EXTINGUISHER SYSTEM

Fire in Flight



One of your deadliest enemies is fire in the air. Fires are the result of a variety of causes, but fall into two types, engine fires and fuselage or interior fires.

Engine Fires

Use this procedure in case of an engine fire, if altitude and other conditions permit.

1. Open cowl flaps
2. Shut off fuel and oil
3. Feather propeller
4. Turn off ignition
5. Set extinguisher selector valve to the proper engine
6. Pull release handle
7. Lower landing gear
8. Do not start engine again
9. Open emergency exits
10. Land as soon as possible to determine the cause of the fire and correct the conditions before continuing the flight.
11. If engine fire extinguishers are not installed, follow the above procedure omitting the instructions at **5** and **6**.

If you have used the built-in extinguisher to put out the fire, never try to restart the engine. Your CO_2 is exhausted and you have absolutely no defense against a recurrence of the fire.

The danger of fire, other than the natural hazard of the flame, is that the heat may melt or damage the control cables, wing spars, etc.

Do your best to put out engine fires, but don't stay with the plane so long that an explosion traps you.

Cabin or Interior Fuselage Fires

To fight cabin or fuselage interior fires:

1. Close all windows and ventilators.
2. Use the hand fire extinguisher on the fire.

For additional information on fighting airplane fires in flight consult **T. O. No. 01-1-156** and P.I.F.

Spontaneous Combustion

A good, clean plane will prevent spontaneous combustion. Clean off all oil or gas when it gets on, or in, a plane. Oily rags, etc., must not be allowed to accumulate.

Miscellaneous

Remove fuses from invertors, instruments, and dynamotors whenever a fire is localized. On late-series airplanes, automatic circuit breakers replace the fuses. Excessive heat breaks the electrical contacts and disconnects the source of trouble.

Take good care of your parachute. Keep it clean and free of grease and moisture.

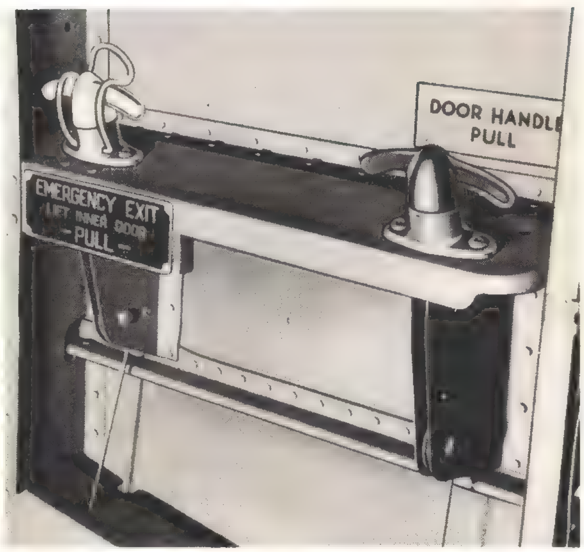
Preflight Your Chute Before Every Flight.

See that there are no loose threads, rips or tears in the case. See that the seal is intact, the release pins straight, and that the chute has been recently inspected and checked.

Instruct your crew in the use of their parachutes and on the necessity for instant obedience to the bailout order. A few seconds' delay at the escape hatch can easily prove fatal not only to the man who hesitates but to the rest of the crew.

You are the last man out. Have your crew well drilled and instructed.

Check with the ground crew on the condition and operation of the escape hatches.



EMERGENCY HATCH RELEASE

7

Procedure

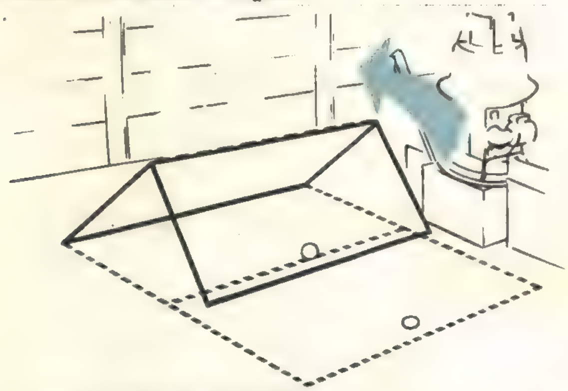
When you decide that the plane should be abandoned use the following signals:

1. **Warning—spoken warning on the interphone.**
2. **Warning—three short rings on the alarm bell.** Each crew member must acknowledge this warning signal.

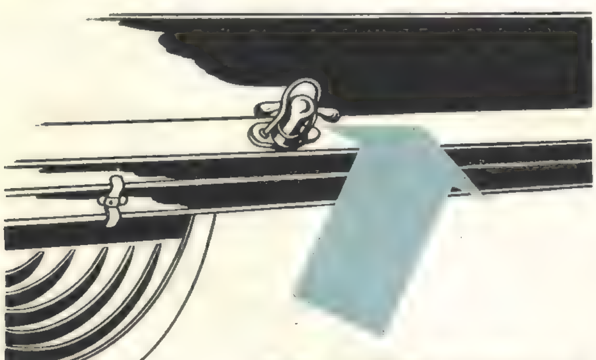
1. **Bailout—bailout order on the interphone.**
2. **Bailout—one long ring on the alarm bell.**

To Open the Escape Hatch

Always open the inner door before you pull the release on the outer hatch. The airstream around the plane creates a low pressure area below the inner door if you drop the outer door before the inner door is opened. This low pressure tends to hold the inner door shut and may make it difficult to open.



OPEN THE INNER DOOR



PULL EMERGENCY RELEASE

Note

When two man crews fly the B-25 leave the inner door open during flight.

HOW TO JUMP

In the navigators compartment of the B-25 it is impossible to use the standard bailout procedure. To jump from this escape hatch use this procedure.

1. Face the rear of the plane.
2. Crouch and place your hands on the rear of the hatch.
3. Drop through the hatch using your hands and arms to protect your face and head from injury.

Use standard bailout procedure to jump from the rear hatch.

1. Face the direction of flight.
2. Assume a crouching position.
3. Roll out head first.
4. When you are sure that you are clear of the plane, look directly at the ripcord release and take hold of the handle.
5. Straighten your legs, keep your feet together, and pull the release. In a low altitude jump pull the release as soon as possible.
6. For further information on bailout technique, consult your personal equipment officer and the Pilot's Information File.

Exits for bailout are as follows:

Forward hatch

1. Engineer (Turret Gunner).
2. Bombardier-Navigator.
3. Copilot.
4. Pilot.

Rear hatch

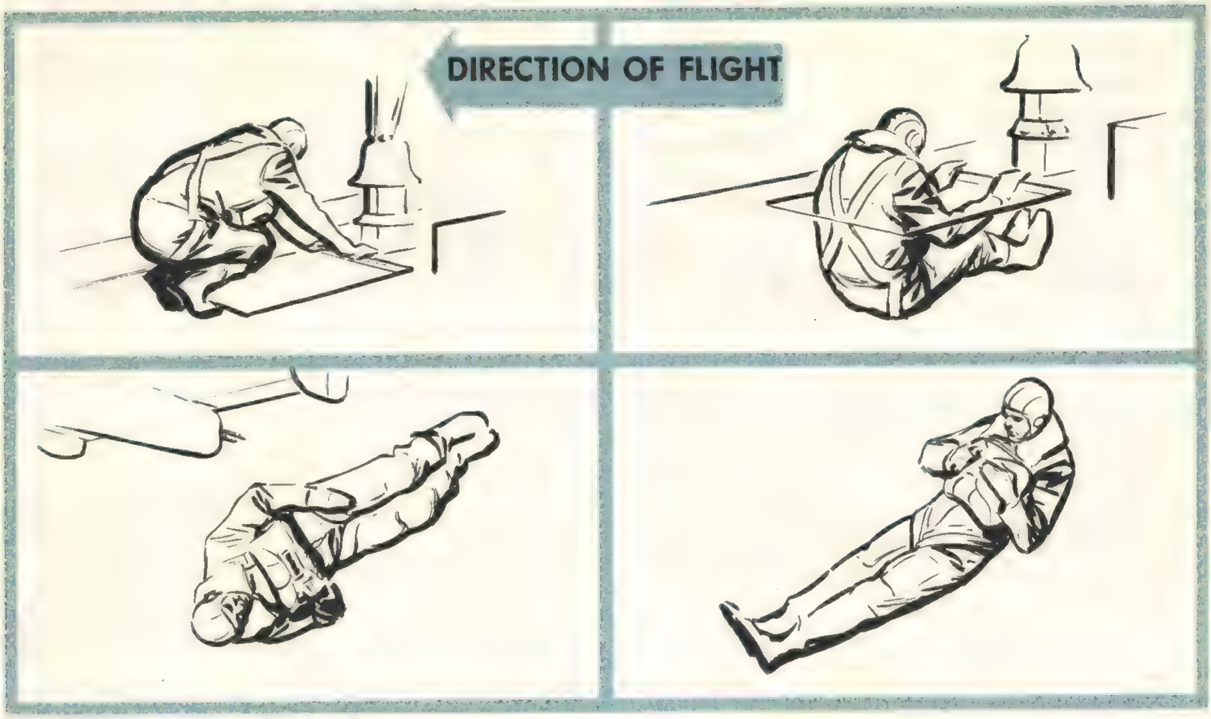
1. Tail Gunner.
2. Radio Operator (Waist Gunner).

If you have had a hydraulic failure, be sure that the bomb bay doors are not partially open. These doors fall open ⅔ of the way when the hydraulic system loses its pressure.

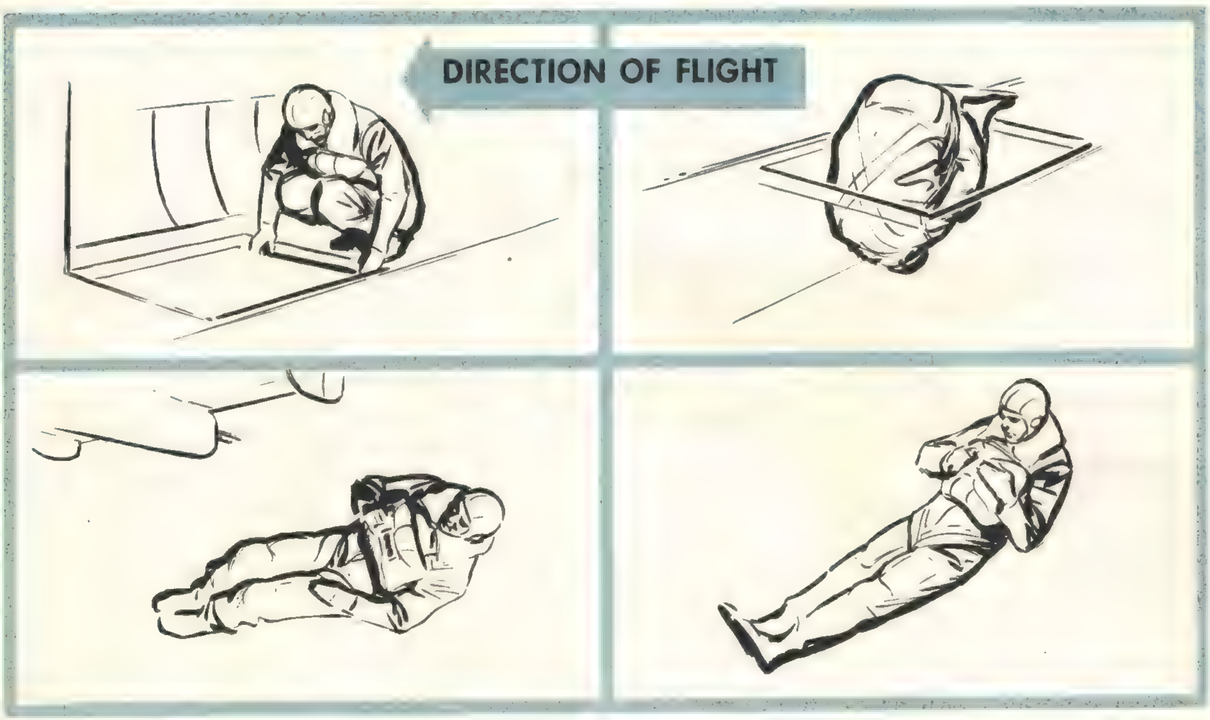
To complete the opening or reclosing of the bomb bay doors follow this procedure.

1. Open the inner door—this door will not open with the bomb bay door hand crank installed.
2. Install crank on coupling.
3. Close or completely open the doors. Close them if you have sufficient time, because there is less danger of hitting them as you jump if they are closed.
4. Complete the bailout procedure.

EXIT THROUGH FORWARD HATCH



EXIT THROUGH REAR HATCH



FORCED LANDINGS

Forced landing in the B-25 is at best a difficult job. Fortunately, the B-25's exceptional single engine ability will bring you home unless you have a failure of both engines. You will seldom need to set down in rough country.

Many pilots have made successful landings in wild, rough country. You can get some valuable tips from their experiences.

Never land wheels-down except on a known airfield. Soft ground, plowed fields, ridges, and gullies cause the plane to nose over and tear up, and increase the fire hazard tremendously.

If you make a belly landing the plane will in most cases toboggan over the ground and escape serious damage.

Although the shock and deceleration are less than in a forced landing at sea, they are great enough to necessitate bracing for the impact. Brace and cushion yourself as well as you can. You will save yourself from some hard knocks, if not more serious injuries.

Pick your spot carefully. If you have any control over where you are to land, pick a spot near a road, phone line, small town, or other settlement. This will insure immediate medical attention or quick communication if medical aid is not on hand.

Prepare the Plane

Throw out excess weight, thus lowering the landing speed.

Throw out loose objects to prevent them from flying through the plane on impact.

Keep first-aid kits on your person. In case of fire they will not be forgotten and burned.

Open the escape hatches to prevent jamming on impact.

Inflate your Mae West to help you absorb the shock of landing.

Prepare the Crew

Remove loose cords, parachute harness, radio cords, etc.

Fasten safety belts and shoulder harness.

Proceed to crash stations and remain throughout landing.

Landing the Plane

Make a normal full-flap approach to the landing.

Do not feather propellers unless it is necessary to stretch the glide. If the props are feathered, the tips will not bend aside on impact but will dig into the ground, rupturing wing tanks and engine mounts and adding to the fire hazard. They may also break and throw tips through the fuselage, creating an unnecessary hazard from the flying metal.

Keep wheels up. Remember, however, that the reduced drag from the wheels in a raised position will increase the normal gliding distance of the plane. Make allowances for this in your landing. Don't make a turn close to the ground at low airspeed. Plan your approach to land straight ahead. Before touching down, cut all switches to reduce the fire hazard.

Make a nose-high landing, but do not exaggerate the attitude to the point where there is danger of throwing the nose into the ground when the tail strikes.

Call the roll immediately after leaving the plane. Be sure that no one is left inside in a dazed condition. In the excitement it is easy to lose a man for a few seconds. If the plane

starts to burn this may be long enough to prevent his rescue. Crash stations and signal procedures are the same as those used for ditching.

Belly Landings

Never try to save the plane at the expense of the lives and safety of your crew. You must make the final decision to bring the plane in for a belly landing or to come in wheels down. In wild, rough country, obviously a belly landing or bailout is your only choice. However, when you have a runway or airfield to land on, avoid a belly landing if possible. Often a belly landing damages your plane so badly that it cannot be repaired.

A few tips gathered from the experiences of other pilots will help you to make the right decision. A study of accident reports reveal that B-25's have been landed with the nose gear retracted, one or both tires flat, brakes locked, and even with one main wheel down and one up. In most cases although the plane was damaged it could be easily repaired. Injuries to crew members were limited to scratches and a few small bruises.

What is safe under one set of conditions may not be safe when faced with different conditions however, in each case the particular conditions will dictate what you must do.

In general you can follow these tips:

1. With one tire flat, make a normal landing and use the brake on the good wheel and tire to hold the plane on the runway. Use the engine on the other side to aid in maintaining control if necessary.

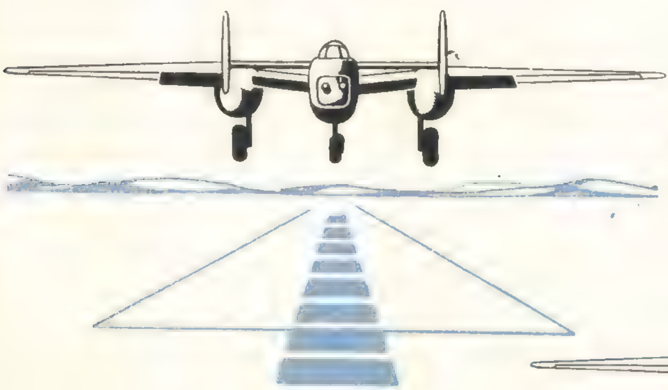
2. With both tires flat make a normal landing and if possible don't use the brakes at all. You can stop with plenty of room left if you land short on the average runway.

3. With the nose gear retracted, shift as much weight to the tail section as you can without making the plane dangerously tail heavy for landing. Have the crew go to the tail section as soon as the main wheels touch down and remain there until the nose can be propped up. Often this technique enables the plane to make a landing on the main wheels and tail skid with no damage.

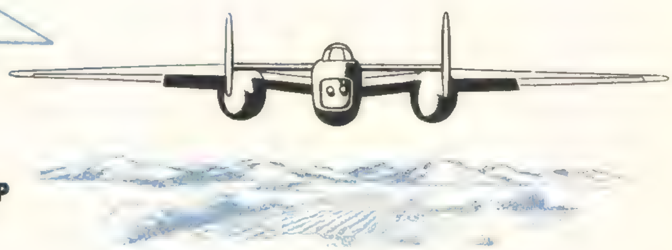
4. With the brakes locked, land short and hang on. The tires should blowout quickly, if they do the plane will slide on the wheel rims with minor damage. The nose gear may fold and allow the nose section to be damaged, but this does not seriously endanger the crew.

In each case if you can save the plane you keep a plane in service that would otherwise have to be replaced.

Remember—never try to save the plane at the expense of the lives and safety of the crew.



WHEELS DOWN



WHEELS UP

With the tactical needs of World War II calling for the operation of land planes over vast stretches of water, airmen faced a new hazard: ditching—the forced landing of land planes at sea.

From the analysis of actual ditching reports, plus the results of tests made with scale models, there has come a body of information from which the best possible ditching procedure has been developed.

Like any procedure, it must be practiced to be effective. Safeguard yourself and your crew by consistent practice.

Successful ditching depends in part on the speed and efficiency with which each crew member carries out his duties, and on the coordination of all efforts.

When to Ditch

Start preparation for ditching as soon as you feel the slightest doubt that your mission will be completed successfully.

You are responsible for the welfare of your crew. It is your duty to see that they are prepared well in advance of the actual ditching.

Do not delay your decision too long. Your crew must have as much time as possible to prepare. Once your decision is made, notify the crew by interphone and the alarm bell "Prepare to ditch!"

Radio Procedure

Start emergency radio procedure immediately. Your best chance for rescue lies in correct and speedy radio procedure before ditching. Radio operator and pilot must fully understand the specific radio procedure in their particular theater of operations.

If you transmit distress signals that you are ditching, but are lucky enough to make land,

be sure to notify the Air-Sea Rescue Unit as soon as possible to avoid danger and loss of time for the crew who may be out searching for you.

Prepare the Plane

Jettison loose equipment. Also jettison all objects likely to be torn loose by the impact. Lightening the plane reduces the landing speed and lessens the impact. Get rid of oxygen walk-around bottles, extra sidearms, cargo. Strip turrets of ammunition, dismantle and jettison guns and radio sets mounted over the bomb bay. Save at least one parachute for each raft. The silk and shroud lines will prove handy in the raft for sail, cover and extra line.

Salvo bombs and the fuselage tank if it is more than half full. If fuselage tank is less than half full, keep it in the plane for added buoyancy.

Collect Very cartridges, pistol, smoke flares, all signaling devices and keep them on your person. Don't hesitate to throw out everything else that is loose or can be pried loose, that you will not need to aid survival and rescue. Often the decreased weight will enable you to remain in the air much longer and bring you closer to land.

Drop all equipment through the lower and side hatches. Be careful to avoid damage to tail surfaces.

Before the landing, close all bottom hatches. Leave the right side hatch open to prevent jamming on impact. If there is not enough time to salvo bombs and fuselage tank (30 seconds), keep the bomb bay doors closed. Open the pilot's escape hatch only when below 1000 feet. Open hatches create drag.

Prepare the Crew

Remove all entangling cords and lines, parachute harness, oxygen masks when below 12,000 feet. Remove flying boots. Wear all other clothing, regardless of temperature. Loosen the clothing about your neck, particularly ties. Wear life vests at all times on over-water flights, but do not inflate them inside the plane. The escape hatches are small and may damage the vests in the exit.

Accomplish your prearranged duties and go to your ditching station at once. Remain there until the landing is completed. Moving around unnecessarily will change the trim of the plane and make the pilot's job more difficult.

Fasten all safety belts and harness before the landing. Use your headsets and mike at your ditching station but do not fasten them to your body.

Above all, remain in your ditching station until the plane has come to rest. More men are injured during the deceleration than at any other time. Terrific forces are generated then; the human body cannot absorb these forces if it is not protected.

Position of Personnel

Pilot—in his seat, full forward and locked, cushion protecting chest.

Copilot—in his seat, seat full back and locked to provide easy access to the escape hatch. If his seat is forward it may block the escape of other crew members.

Engineer—behind the copilot's seat facing the rear of the plane, braced and cushioned.

Bombardier-Navigator—Behind pilot's seat facing the rear of the plane, braced and cushioned.

Radio operator—on his seat, back against the bomb bay wall, safety belt fastened.

Tail Gunner—beside the radio operator on the floor. If the airplane has a footwell for the radio operator, up-end a radio coil in this space and sit on that to avoid a cramped position.

If the head protrudes above the support at the back, hold it firmly in position with the hands across the base of the skull, pulling down firmly against the neck muscles. It has been found that the body in this position will absorb shocks far greater than those encountered in ditching.

Approved Braced Positions

For any crew member who for any reason can not ditch in his normal position or for passengers, the following positions are recommended:

1. Secured by a safety harness.
2. Seated with back against a forward bulkhead, hands clasped behind head.
3. Prone with back on floor, feet braced against a forward bulkhead, knees flexed.
4. Braced against a ditching belt.

CREW DUTIES

Pilot's Duties

Make the decision to ditch.

1. Warn the crew by alarm bell (six short rings) this bell is attached to all positive leads on the plane. If either battery-disconnect is on and any current remains in the battery, it will operate.
2. Use the interphone—get an acknowledgment from each crew member.
3. Turn IFF to "EMERGENCY."
4. Check the fuselage tanks and bombs, and salvo if necessary. Close the bomb bay doors—they must not be open for the landing.
5. Landing gear up—check it!
6. Get wind direction and velocity from navigator.
7. Signal copilot to lower flaps as required.
8. Notify crew to brace for the impact (interphone and bell) **(one long ring).**
9. Exit through forward escape hatch.

Copilot's Duties

1. Switch to interphone and acknowledge the emergency bell warning.
2. Help the pilot salvo bombs and fuselage tank. (Keep fuselage tank if less than half full.)
3. Check to see that the gear is up.
4. Assist the pilot in getting wind's direction and velocity from the navigator.
5. Release the pilot's emergency hatch.
6. Lower flaps as required on pilot's signal.
7. Brace for impact.
8. Abandon ship through forward escape hatch after it has come to rest. Check to see that the life raft has released properly. If not, **release it manually.**

Bombardier-Navigator's Duties

1. Pass speed, course, altitude, position and estimated ditching position to Radio Operator.
2. On signal from Pilot, assume ditching position and brace for ditching.

Radio Operator's Duties

1. Switch to interphone and acknowledge the emergency bell.
2. Immediately begin sending the distress signal.
3. Receive position from the navigator and transmit it.
4. Send emergency (XXX) followed by message containing information from Navigator. Obtain fixes and bearings.
5. Obtain first-aid kit. Keep it in your possession.
6. On a signal from pilot to brace for impact, lock the transmitting key, swing around to the side and brace for impact.
7. Release life raft.
8. Abandon through rear escape hatch after plane has come to rest.

Engineer's Duties (Turret Gunner)

1. Acknowledge the emergency bell.
2. Check the bomb bay tank and inform the pilot of the amount of gasoline.
3. Jettison all unnecessary equipment through bomb bay or through entrance hatch. Make sure entrance hatch is securely latched.
4. On the pilot's signal, assume ditching station and brace for impact.
5. Abandon the plane through upper escape hatch.

Tail Gunner's Duties

1. Acknowledge the emergency signal bell by interphone.
2. Remove the rear escape hatch. Jettison all loose equipment, ammunition cans, guns, etc.
3. See that all rear personnel have their life vests on and that the vests **are not inflated.**
4. Brace for the impact on the pilot's signal.
5. Abandon ship through rear escape hatch. See that radio operator has released the life raft.

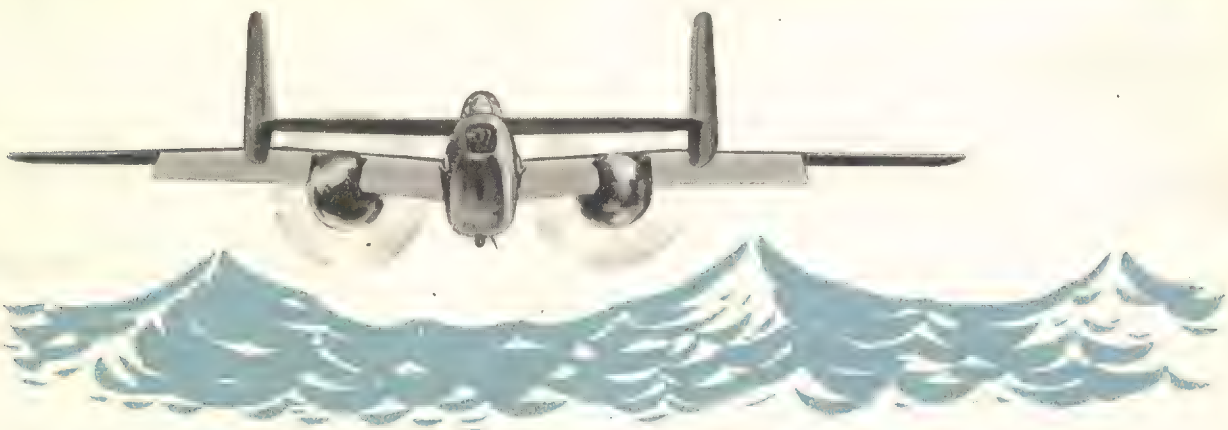
Landing Procedure

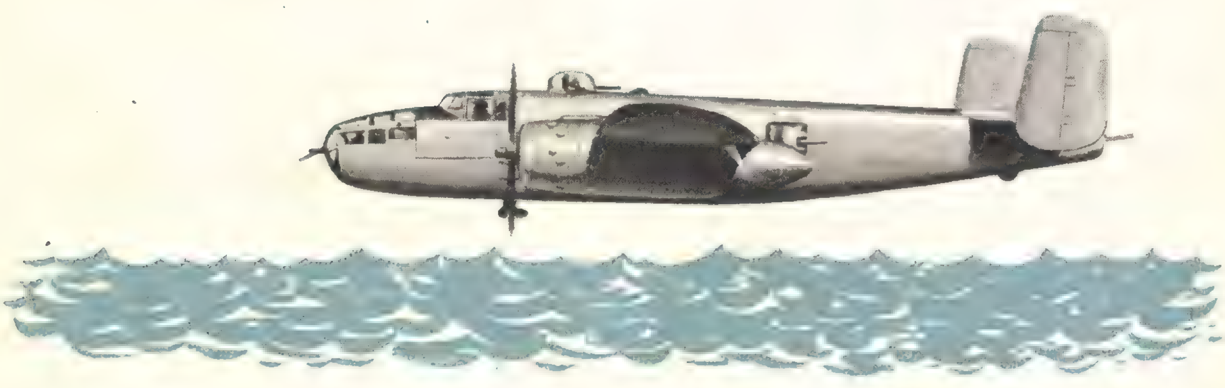
Consult the PIF and your personal equipment officer for general information on ditching. They will help you with your problems.

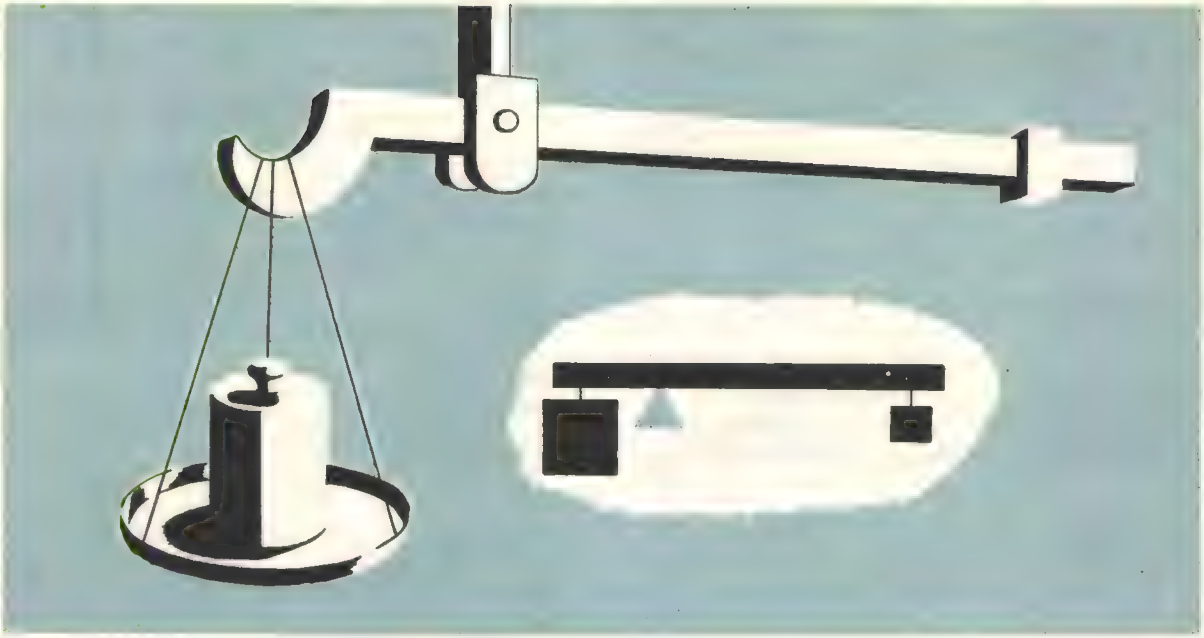
Pilot determines direction of approach well in advance, touchdown parallel to lines of crests and troughs in winds up to 35 MPH. Ditch into wind only if wind is over 35 MPH or if there are no swells. Use flaps in proportion to power available to obtain minimum safe forward speed with minimum rate of descent. In every case try to ditch while power is still available. Touchdown in a normal landing attitude. Severe decelerations may be expected and several impacts so warn your crew not to move until the airplane has come to rest. The airplane can be expected to float with the nose low in the water and may sink in less than one minute. So your crew must be trained to make a quick orderly exit.

How to determine the approximate wind speed from the state of the sea:

A few white crests—10 to 20 MPH
Many white crests—20 to 30 MPH
Foam streaks on water—30 to 40 MPH
Spray from crests—40 to 50 MPH







WEIGHT

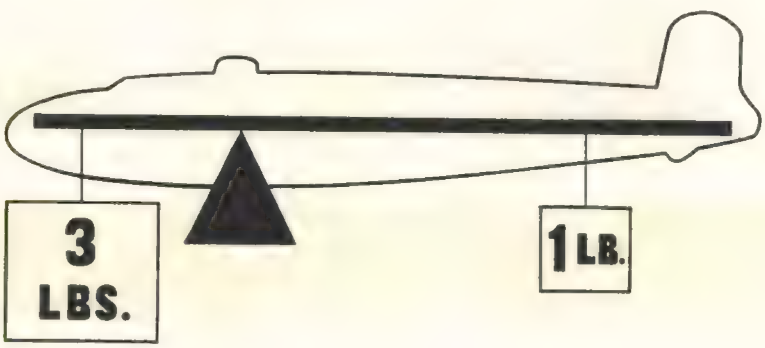
and Balance

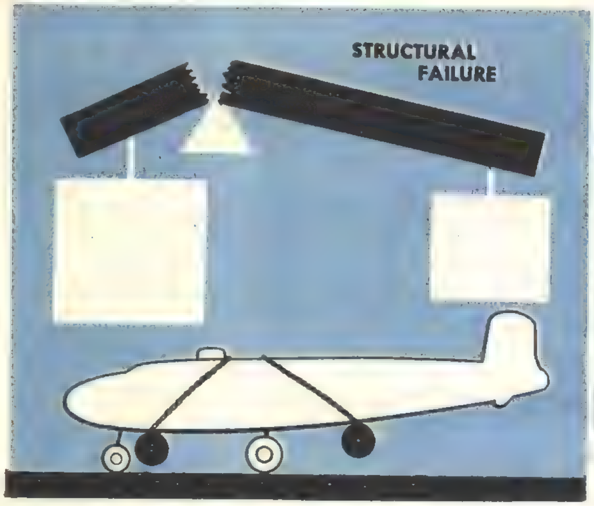
The day when a pilot flew by guesswork is past. One by one the decisions that were made by intuition, hunches, and guesswork have been taken over by an orderly system based on knowledge and understanding. Invariably this has resulted in greater safety and operating efficiency.

In the loading of heavy bombers this is especially true. Ever-changing tactical requirements, calling for more and more complex combinations of cargo, fuel, crew, and armament, have made any but precise, accurate methods too dangerous to consider. This need to get the utmost in efficiency from every flight highlights the need for precise control of weight and balance.

Improper loading, at best, cuts down the efficiency of an airplane. Maneuverability, rate of climb, speed, and ceiling suffer greatly.

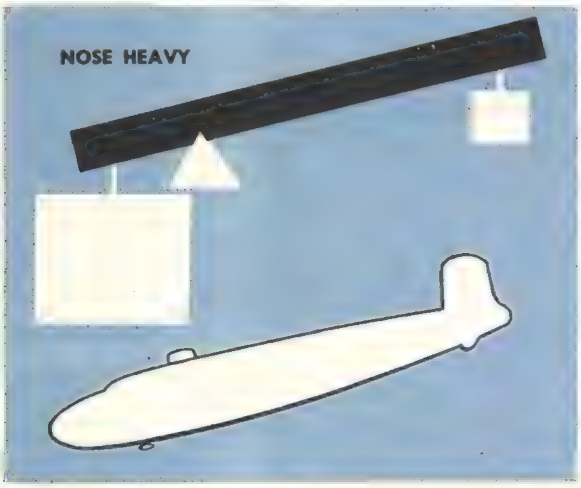
At its worst, it may mean failure to complete a flight, and sometimes failure even to start a flight, in most cases with a loss of life and destruction of valuable equipment.





Overload

1. Causes higher stalling speeds.
2. Lowers structural safety limits.
3. Reduces maneuverability.
4. Increases length of the takeoff run.
5. Lowers the angle and rate of climb.
6. Decreases ceiling.
7. Increases fuel consumption for a given speed.
8. Overloads the tires.



CG Too Far Forward

1. Increases dives beyond control.
2. Causes unstable, nose-down tendencies when flaps are lowered.
3. Increases difficulty in raising nose on landing.
4. Overloads nosewheel and tire.
5. Increases pilot strain in instrument flying.
6. Dangerous if tail structure is damaged.

CG Too Far Aft

1. Increases stall tendency.
2. Limits low power operation.
3. Decreases speed.
4. Decreases range.
5. Increases pilot strain in instrument flying.
6. Dangerous if tail structure is damaged.

PRINCIPLES OF WEIGHT AND BALANCE

Proper Balance

An airplane is properly balanced when it will remain approximately level if suspended from a definite point within its center of gravity range.

Center of Gravity Range

The center of gravity range is the maximum fore-and-aft limits within which the balance of the airplane's weight must lie if the plane is to

fly safely. This center of gravity range is near the leading edge of the wing where the maximum lift occurs.

Balancing the B-25

Balancing the B-25 is simply a matter of distributing the weight so that the center of the airplane's loaded weight falls within the center of gravity range.

Weighing the B-25

The B-25 is weighed to determine the basic weight of the airplane and to find the point at which this weight is balanced.

Charts and Forms

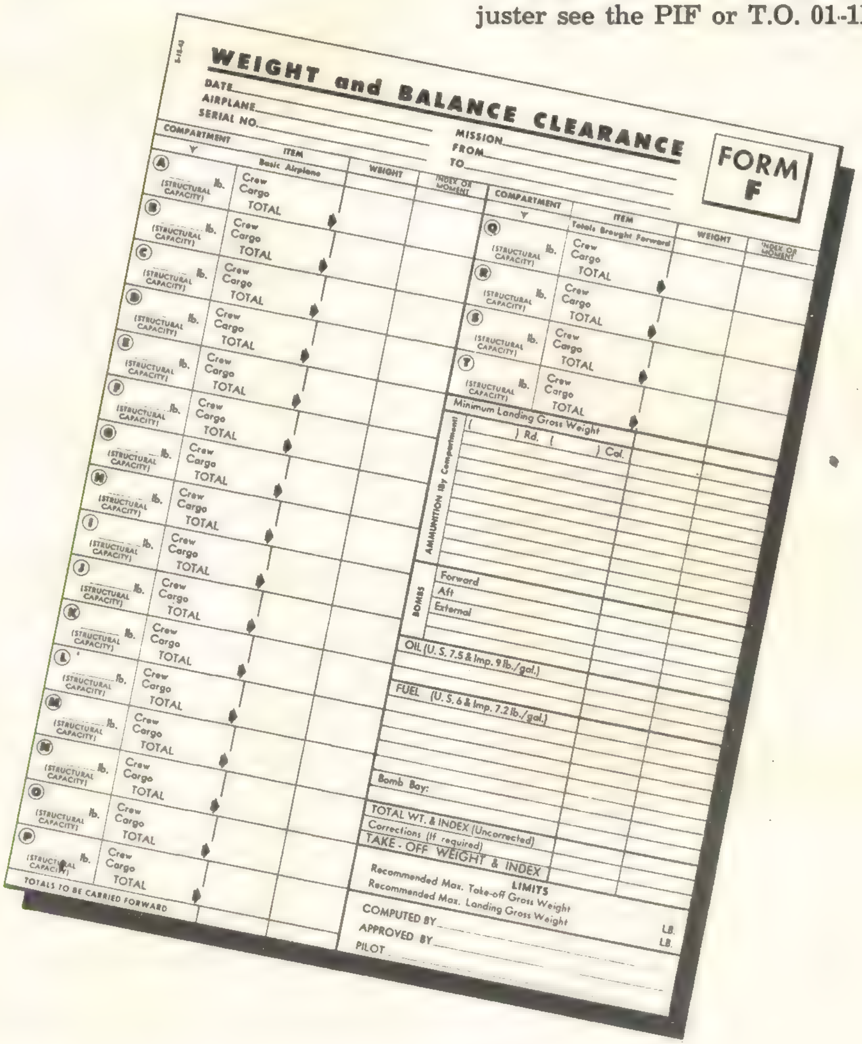
There are various charts and forms for controlling the weight and balance of the B-25. These may be found in T.O. 01-1B-40. For information on these charts and forms consult your weight and balance officer or T.O. 01-1B-40.

Form F

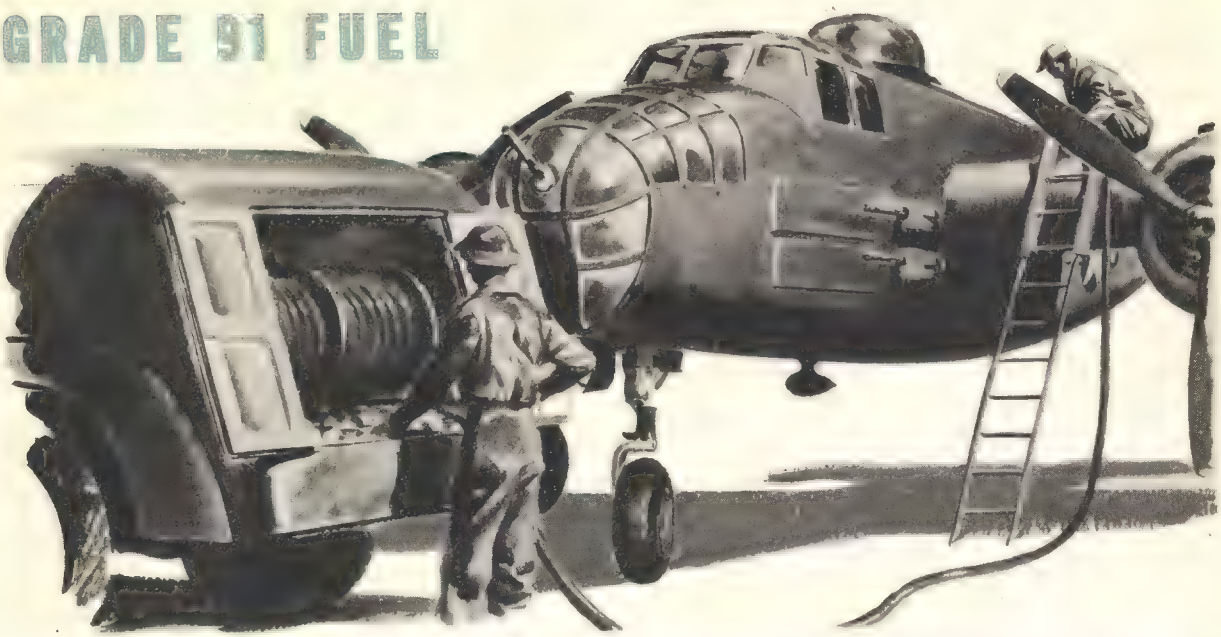
The Form F vitally concerns the pilot. This is the record of the distribution of weight in the airplane. It will tell you the CG step by step as each item is placed in the plane.

You must fill out this Form F before every flight. One copy is filed and one copy remains in the **Weight and Balance Handbook** of the plane.

For instructions on the use of the load adjuster see the PIF or T.O. 01-1B-40.



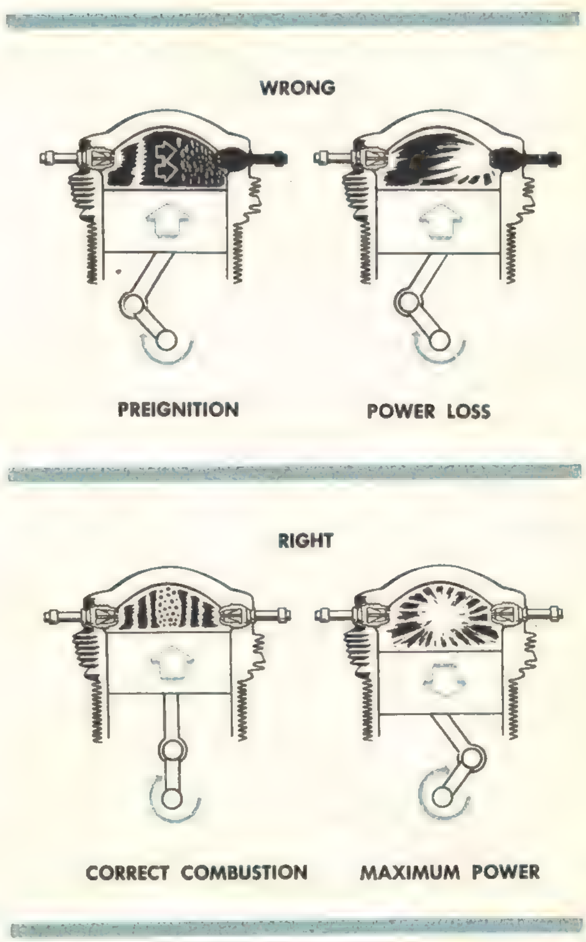
GRADE 91 FUEL



With our entry into World War II, and our operations on fighting fronts the length and breadth of the world, it became apparent that we could not produce high-octane fuels quickly enough to meet the demand.

For this reason, all training and operational flights in the continental United States are made on Grade 91 fuel whenever possible.

The operation of the B-25 on Grade 91 fuel is perfectly safe. With a thorough knowledge of its operating limits you will have no trouble at all.



What Is an Octane Rating?

To properly understand the evaluation of fuels it is necessary to review some basic facts. Let's start with some definitions:

Pre-ignition

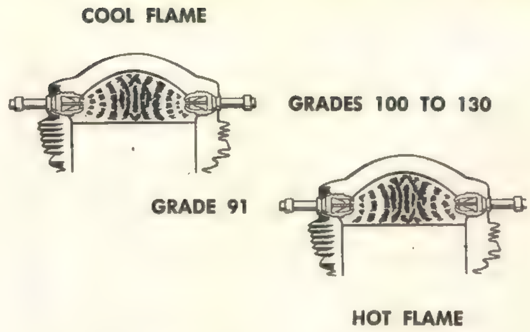
Pre-ignition is a condition of premature firing. The fuel charge in the cylinder head is ignited by a hot carbon deposit or other means before time for the electrical firing to occur.

Normal Combustion

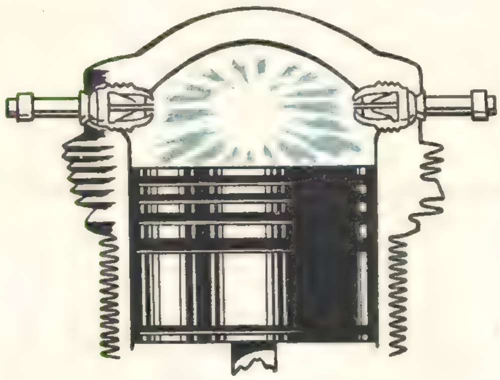
Normal combustion is the burning of the fuel charge in the cylinder head as a slow-burning wave, creating power not as an explosion, but as an expansion of the gases.

Detonation

Detonation, as the name implies, is an explosion in the cylinder head. The normal burning wave as it travels across the cylinder head subjects the unburned portion of the fuel charge to tremendous temperatures and pressures. If these forces are great enough the remaining fuel charge explodes before it can burn, and the shock waves from this explosion are great enough to blow the cylinder head off the engine.



RELATIVE COMBUSTION TEMPERATURES FOR DIFFERENT GRADES OF FUEL


DETONATION

Octane Rating

Octane rating of a fuel is a mathematical grade assigned to a fuel in direct proportion to its ability to withstand pre-ignition and detonation.

Two reference fuels were chosen, iso-octane and normal heptane. Run in a test engine, these fuels respond identically under identical conditions.

To rate a new fuel it is compared to these reference fuels. If it matches the anti-knock ability of iso-octane it is rated as Grade 100 fuel. If its performance is less, normal heptane is added to the iso-octane. Thus, if a fuel matches in performance a mixture of 87% iso-octane and 13% normal heptane it is rated as Grade 87 fuel.

How Does This Affect the B-25?

You control the initial pressure that is allowed to enter the cylinders of the engines. This pressure after entering the cylinders is compressed and fired at a predetermined ratio.

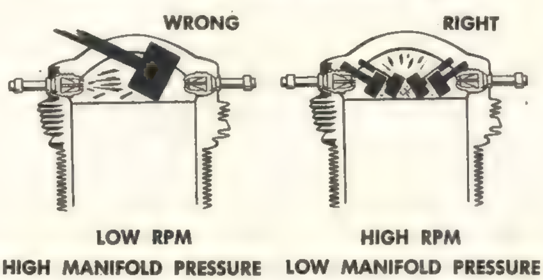
You exercise a control over the temperature at which the engines run. If you allow great pressures to enter the engine, or allow the engine to operate at excessive temperatures, you can be sure of disastrous consequences.

The pressure entering the engine is determined by a relation of manifold pressure and rpm. Temperature is controlled by allowing the engine to get proper cooling.

Learn the power limits you can use with different grade fuels at different altitudes.

The accompanying power control chart shows maximum limits, minimum limits, and the desirable range to increase the life and efficiency of the engines.

EFFECTS OF RELATION BETWEEN $\frac{\text{RPM}}{\text{MP}}$



EL(S)
-25J
13 OR R-2600-29

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 30,000 TO 26,000 POUNDS

EXTERNAL LOA
NONE

BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	TOTAL G.P.H.
LOW	FULL RICH	5 MIN	230
LOW HIGH	FULL RICH	5 CONT.	215 190
LOW HIGH	FULL RICH	CONT.	180 190

INSTRUCTIONS FOR USING CHART: Select figure in FUEL column equal to or less than amount of fuel to be used for cruising. Move horizontally to left or right and select RANGE value equal to or greater than the statute or nautical air miles to be flown. Vertically below and opposite desired cruising altitude (ALT.) read optimum R. P. M., I. A. S. and MIXTURE setting required.

NOTES: Column I is for emergency hi Columns II, III, IV and V give progressive sacrifice in speed. Manifold pressure (M (G. P. H.) and true airspeed (T. A. S.) for reference. For efficiency main (I. A. S.) hourly. Adjust RPM slightly ceeding manifold pressure more than 3 i

(cropped)	FUEL	II		III		IV		FUEL	(cropped)
		RANGE IN AIR MILES		RANGE IN AIR MILES		RANGE IN AIR MILES			RA
ICAL	U. S. GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	U. S. GAL.	STATUT
	974	① 74 GAL. ALLOWANCE NOT AVAILABLE IN FLIGHT					①	974	
0	900	940	820	1140	990	1470	1280	900	1680
9	800	840	730	1010	880	1310	1140	800	1500
00	700	730	630	890	770	1150	990	700	1310
80	600	630	540	760	660	980	850	600	1120
0	500	520	450	630	550	820	710	500	930
90	400	420	360	510	440	650	570	400	750
0	300	310	270	380	330	490	420	300	560
0	200	210	180	250	220	330	280	200	370
70	100	100	90	120	110	160	140	100	180

US			OPERATING DATA (II)						OPERATING DATA (III)						OPERATING DATA (IV)							MA	
G. P. H.	T. A. S.	ALT. Feet	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	R. P. M.	I. A. S. M.P.H.	MIX-TURE	M. P. In. Hg.	G. P. H.	T. A. S.	ALT. Feet	R. P. M.	I. A. M. P.
		40000																			40000		
		35000																			35000		
		30000																			30000		
		25000																			25000		
260	270	20000	2300	185	F.R.	F.T.	240	260	2150	180	F.R.	F.T.	200	250	1950	160	C.L.	F.T.	140	225	20000		
340	285	15000	2200	215	F.R.	35	260	275	2250	205	F.R.	F.T.	205	260	2100	190	C.L.	F.T.	145	245	15000		
305	280	10000	2250	230	F.R.	F.T.	260	275	2100	220	F.R.	30	205	260	2050	205	C.L.	29	145	240	10000	1850	17
340	280	5000	2200	235	F.R.	33	250	260	2050	220	F.R.	31	190	240	2000	205	C.L.	29	135	225	5000	1700	17
315	260	S. L.	2150	235	F.R.	34	230	240	2050	220	F.R.	31	175	225	1950	205	C.L.	29	125	210	S. L.	1500	17

NOTES
. FOR WARM-UP, TAKE-OFF & INITIAL CLIMB
E FOR WIND, RESERVE & COMBAT AS REQ'D.

BOVE HEAVY LINE ONLY
GIVEN ARE FOR AIRPLANES EQUIPPED
TH 1685 HA CARBURETOR ONLY.

EXAMPLE
AT 29,000 LB. GROSS WT. WITH 900 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 74 GAL.) TO FLY 1400 STAT. AIRMILES AT 10,000 FT. ALT. MAINTAIN 2050 RPM AND 205 MPH IND. AIRSPEED WITH MIXTURE SET CRUISING LEAN.

LEGEN
I. A. S.: INDICATED AIRSPEED
M. P.: MANIFOLD PRESSURE
G. P. H.: U. S. GAL. PER HOUR
T. A. S.: TRUE AIRSPEED
S. L.: SEA LEVEL

Check for the Proper Chart

Series B-25J

Weight 30,000 to 26,000 lbs.

External Load — None

Work the Problem

1. Fuel available — 900 gals.
2. Distance — 1400 miles
3. Settings for Altitude 10,000 feet
   2050 rpm
   Cruising Lean
   205 mph Cruising AS

COLD WEATHER OPERATIONS

Cold weather operations bring visions of long arctic nights, glaciers, Eskimos, and stories you have heard of the Far North.

But it is well to bear in mind that during the winter months many sections of the United States have climatic conditions requiring just as much specialized maintenance as the Arctic.

Granted that the conditions are not as severe, it is still important that you know how to care for your plane.

Starting Engines

Make a normal start by following the procedure on the pilot's checklist. If you have trouble starting the engines, take the following supplementary measures:

1. Pull the props through about 15 blades before engaging the starter. The engines will need a lot of priming for a cold weather start. If possible use external power for cold weather starting.
2. If the engine fails to start, check plugs for moisture. Make another attempt to start the engine when the plugs are dry.
3. Always make a normal start before using the oil dilution system. If, after the engines are running, your oil pressure is too high or is fluctuating and drops off when the rpm is increased, dilute the oil. (See dilution procedure under After Landing.)

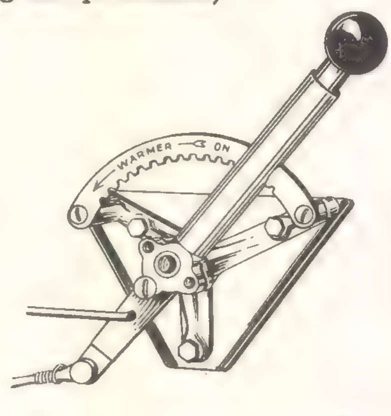
Note: Use this method only if time and extreme temperature conditions do not permit normal engine warm-up.

4. Do not run the engines at more than 1200 rpm until the oil has reached a temperature of 20°C.
5. If icing conditions exist, place carburetor air control handles in "ICING" until the induction system is free of ice.

Takeoff

1. Never take off if there is any snow, ice, or frost on the wings. Even the thinnest layer of frost may cause loss of lift and treacherous stalling characteristics. In extreme conditions it may be necessary to taxi out to the takeoff position before removing the protective covers from the flight surfaces.
2. In ordinary operation, carburetor air controls should be in "NORMAL" for takeoff. In extremely cold weather, however, it is often advisable to place carburetor air control in "ICING" during takeoff to insure proper fuel vaporization.

(You will seldom find these extreme conditions in the continental United States. In arctic zones, consult experienced pilots before employing this procedure.)



Warning

Your cabin heaters must be "OFF" before takeoff.

Flight

1. Your anti-icing and de-icing equipment is primarily intended as a means of getting you **out** of icing levels. Don't fly in icing levels any longer than is absolutely necessary.

2. Check your free air temperature gage before any flight where ice is anticipated.

3. After taking off from snow or slush-covered fields, operate the landing gear and flaps through several cycles to insure against the gear and flaps freezing in the up position.

4. Turn the pitot tube heater "ON" when moisture is present. Pitot tube heat should not be applied until the airplane is on the takeoff run or actually in the air, as there is insufficient cooling in the pitot head while the plane is stationary. **Note:** With pitot tube heat "ON" your magnetic compass may oscillate as much as 15°.

ANTI-ICING

Emergency provision is made to prevent ice formation on the propellers, and on the bombsight window by an alcohol anti-icing system.

The alcohol anti-icing system has two supply tanks, one in each engine nacelle against the outboard wall. They carry isopropyl alcohol. The tank in the right-hand nacelle has a capacity of 10 gallons and supplies fluid through separate line systems for anti-icing of the propeller blades and the bombardier's window. A standpipe reserves 1.5 gallons for the bombsight window after the supply for the propellers is exhausted. The tank in the left-hand nacelle is used for carburetor de-icing. It is similar to the one in the right nacelle except that special inter-rib recesses on the outboard side increase the capacity to 15 gallons. Each system has its own pump, filters, and check valves to keep the fluid readily available near the point of application and to prevent draining of the fluid during dives.

There is no fluid level gage inside the airplane. The fluid level is checked by means of overflow plugs mounted on the tank.

Propeller Anti-Icing

Conventional slinger rings are provided for the propellers. A fluid metering pump in the right-hand nacelle forward of the tank is controlled by a rheostat on the pilot's switch panel. With a slight turn to the right, the control operates the pump at its maximum speed. Further rotation of the control to the right reduces the speed of the pump to any desired volume. The pump is capable of supplying from .36 to 3.17 gallons per hour to each propeller ring.

Whenever icing conditions are encountered, start the pump immediately in order to supply sufficient fluid to coat propeller surfaces before ice formation if possible. However, if ice has already formed—as indicated by rough engine performance – turn the rheostat to fast-flow position until the ice has been removed and the engines run smoothly. Then turn the rheostat to a position which will supply sufficient fluid to prevent further ice formation. Use the fluid as sparingly as possible. Remember that the capacity of the supply tanks is only 10 gallons. Keep in mind the length of time you may have to use the pump and the fact that the fluid in the reservoir must also be kept available for anti-icing the bombardier's window. During missions on which the bomb window anti-icing system is not needed, the fluid supply in the reservoir is sufficient for 1 hour and 20 minutes' continual operation with the rheostat turned to the fast-flow position. At the minimum flow setting, the supply will last for 11 hours and 48 minutes.

Bombsight Window

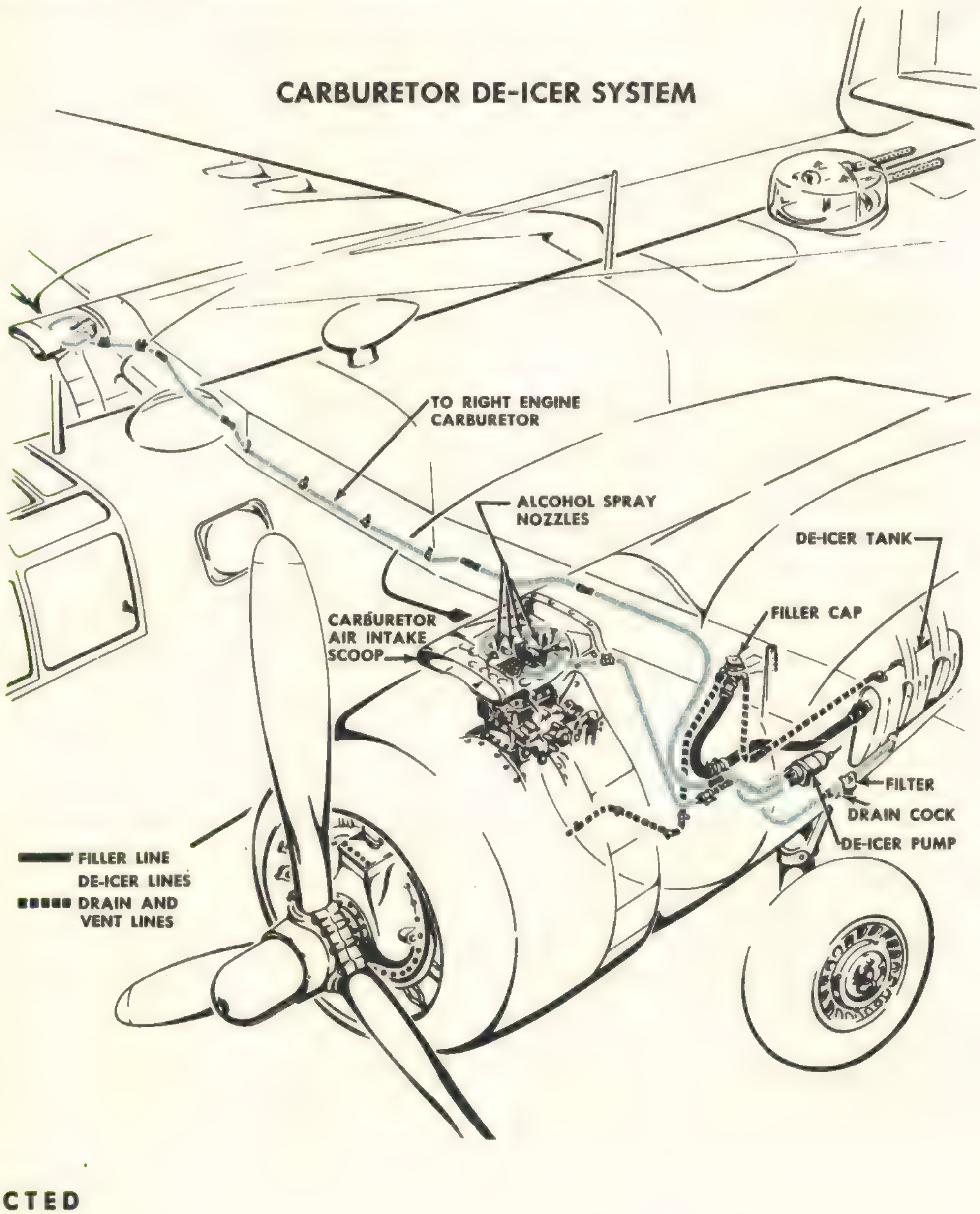
The bombardier's compartment window has perforated anti-icing tubes across the top of the center panel, plus a vertical wiper assembly. Fluid for the spray tube comes from the same tank used for the operation of the propeller anti-icer. The available supply includes the 1.5 gallons reserved by the standpipe within this tank. A rheostat control mounted forward of the instrument panel on the left side of the bombardier's compartment regulates fluid flow.

The check valve in the fluid supply line to the bomb window tubes is in the compartment ceiling and is readily available to the bombardier should minor adjustments be necessary during flight. Turning the visible screw to the right restricts the rate of flow.

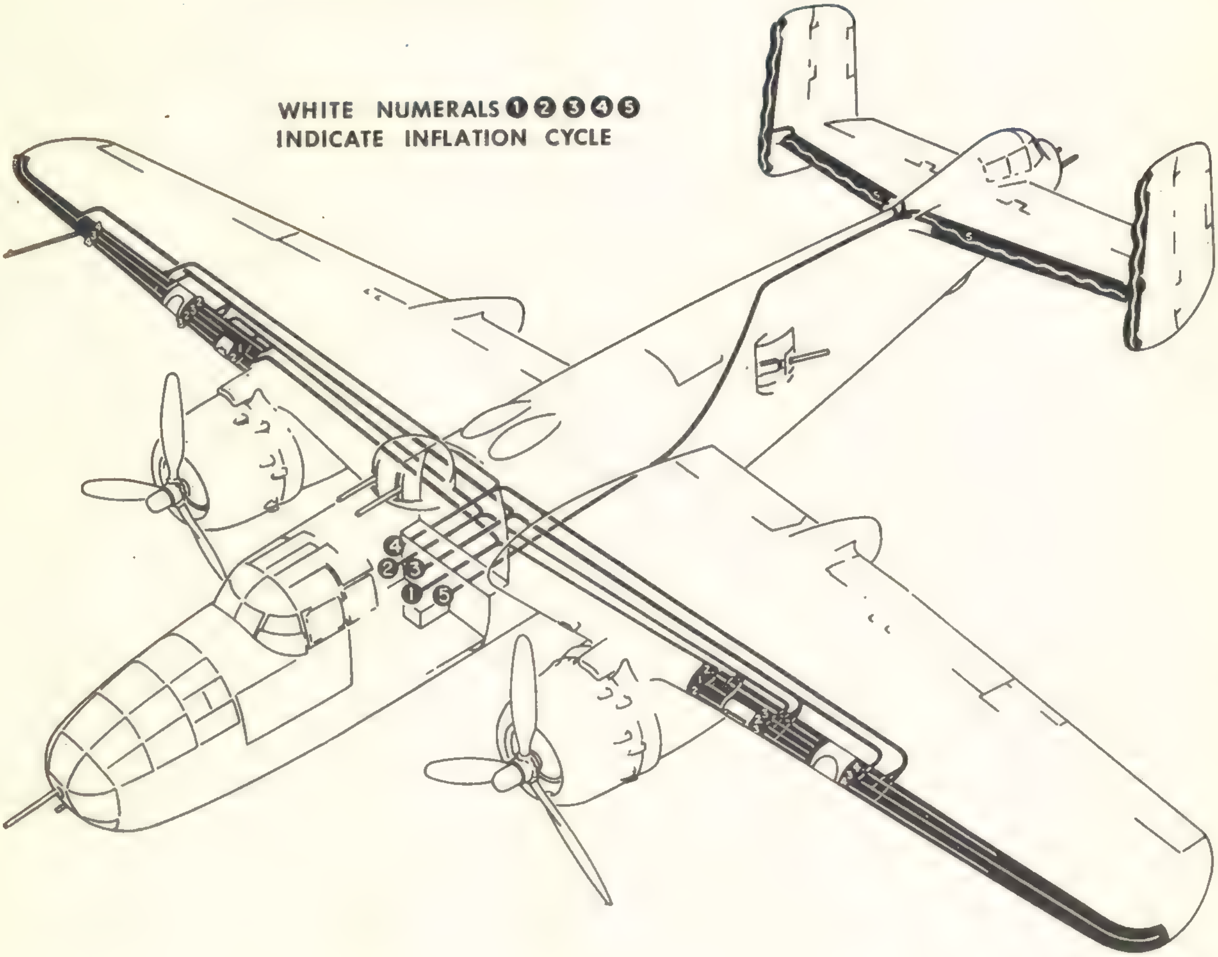
The electric motor which drives the windshield wiper through a flexible cable assembly is controlled by two switches in the lower left corner of the box control panel. The first switch may be set to "FAST" or "SLOW" and the motor turned "ON" by means of the second switch. To prevent injury to the motor or the wiper, the switch must not be turned "ON" while the bomb window is dry.

The installation of this equipment precludes the use of a pilot's windshield spray. A field service installation may, however, be made on these aircraft to provide a clear-vision windshield. This is a 6-ply, chemically treated glass window. The outboard sections are in a neutral pressure area and may be removed in extreme icing conditions to provide direct vision ahead.

CARBURETOR DE-ICER SYSTEM



SURFACE DE-ICER SYSTEM



Conventional air-inflation de-icer boots are mounted on leading edges of wings and empennage. A rotary distributor valve in the well of the navigator's compartment furnishes air to the boots in a 5-phase cycle every 40 seconds.

When the de-icer system is not in operation, suction provided by the vacuum pumps on both engines prevents aerodynamic negative pressures from raising the de-icer boots.

Operation of the surface de-icing system is automatic when the control is turned "ON."

There is a pressure gage for the de-icer system in the rear of the navigator's compartment. This gage should read approximately 7 lb. sq. in. under normal operating conditions. Should the pressure go above 10 lb. sq. in., the maximum pressure, immediately turn the control "OFF" and check for the difficulty.

Caution: Do not operate the de-icer during landing or takeoff. Never operate the de-icer system at speeds above 230 mph; negative pressure on leading edge of wings will expand the de-icer boots, causing them to rupture.

DEFROSTING SYSTEMS

The pilot's windshield section, bombardier's bombsight window, bombsight, and the navigator's astrodome can be defrosted by warm air from the airplane heating system. The bomb bay window, the astrodome, and the pilot's windshield receive heat whenever the heating system is on.

The bombsight warm air supply is controlled by a lever on the defrosting tube located on the left side of the bombardier's compartment.

There is a door for cleaning the bombsight window. When not in use, the bombsight defrosting tube can be stowed in clips along the left side of the bombardier's compartment.

When not in use, the end of the astrodome defroster tube can be stored on the left side of the navigator's compartment directly inboard of the window on the upper longeron. To use it, attach the end of the tube to the nozzle permanently installed in the astrodome, or place it in the alternate position by hooking it to the rear of the astrodome.

There is a flexible auxiliary defrosting tube on the floor of the pilot's compartment at the base of the control column. You can remove the free end from the storage clip and extend it as needed for defrosting the interior of the top side windows in the pilot's compartment. The push-pull selector control on the lower panel in front of the copilot directs the flow of air either to the windshield or to the auxiliary defrosting tube.

Special blowers assist the flow of air to the pilot's compartment defrosting system and to the bombsight window in the bombardier's compartment. Switch controls for the blowers are on the pilot's switch panel and on the bombardier's control panel.

This heating and defrosting system is slightly modified and adapted for the different series of B-25 planes. There are no provisions for heating or defrosting the nose of the series G and H planes, and other slight changes occur in other models. Information on these changes may be found in the T.O.'s for these planes.

HEATING SYSTEM

The airplane has two independent heating systems; one for heating the navigator's, pilot's, and bombardier's compartments, the other for heating the radio operator's compartment and the interior of the fuselage aft of it. Each system has a Stewart-Warner heater burning a mixture of fuel and air. The forward heating system will operate only when the left engine is running, and the aft system only when the right engine is running.

The heater for the forward system is in the left wing center section and a system of hot air ducts leads forward along the left wall of the fuselage. The pilot may obtain more air at high altitude and slow airspeed by operating the air flow control at the left side of his seat. The air travels from the intake scoop on the leading edge, through the heaters, to valve equipped outlets in each forward compartment.

Controllable cold air scoops are provided for the pilot, copilot, and bombardier.

Do not open any of the three escape hatches during flight to obtain ventilation. The drag these open hatches create lowers the efficiency of the plane and in some flight attitudes will cause unstable flight characteristics.

A direct control for the aft heater system, mounted on the heater itself, is just aft of the lower turret on the left wall of the radio operator's compartment.

There is also a master control switch on the pilot's switch panel for emergency use and to aid the pilot in keeping the heater off during takeoff and landing. The flexible tube leading from the blower and heater unit heats the interior of either the upper or lower turret.

The heating and ventilating system is designed so that you can always obtain hot or cold air when either heater is on or off, respectively, by opening air outlets in the compartment. The temperature of the air is regulated by the air temperature control in the navigator's compartment, which sets the heater in operation and governs its heat output. Both the air temperature control and the pilot's air flow control regulate the heating and defrosting air simultaneously.

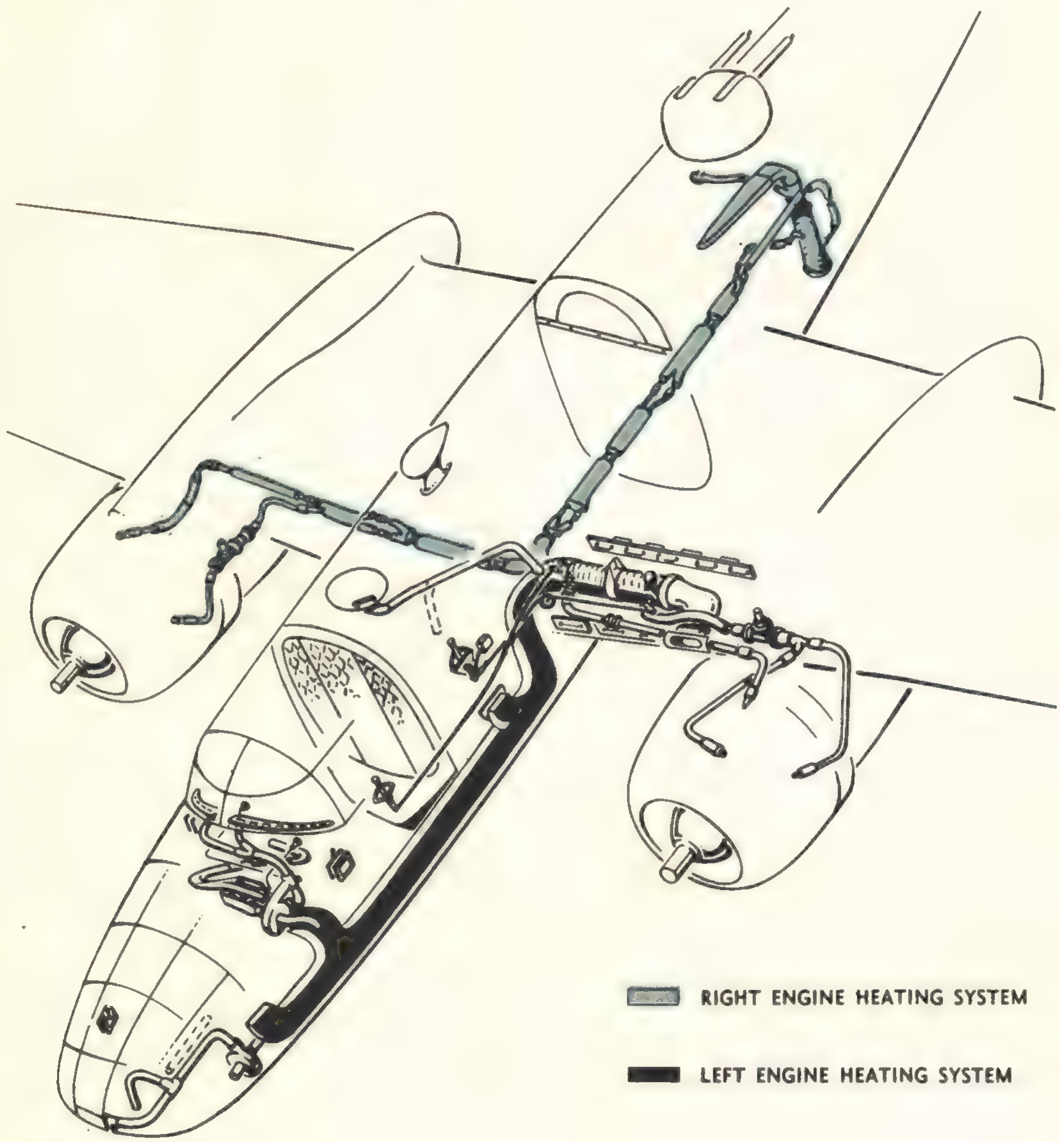
The first movement of the heater control in the radio operator's compartment actuates a micro-switch turning the heater igniter on and starting the blower. Additional movement of the control opens the heater throttle for additional heat output.

The heater in the left wing center section will automatically shut off its heating chamber if it becomes too hot, and will re-start when the temperature lowers.

If the temperature in the wing compartment that contains the heater becomes too high, the heater will automatically shut off but will not re-start until it has been serviced.

Warning

WHEN TAKING OFF OR LANDING, IN ORDER TO HAVE FULL POWER AVAILABLE, HEATING SYSTEM MUST BE OFF.



HEATING SYSTEM LATE AIRPLANES

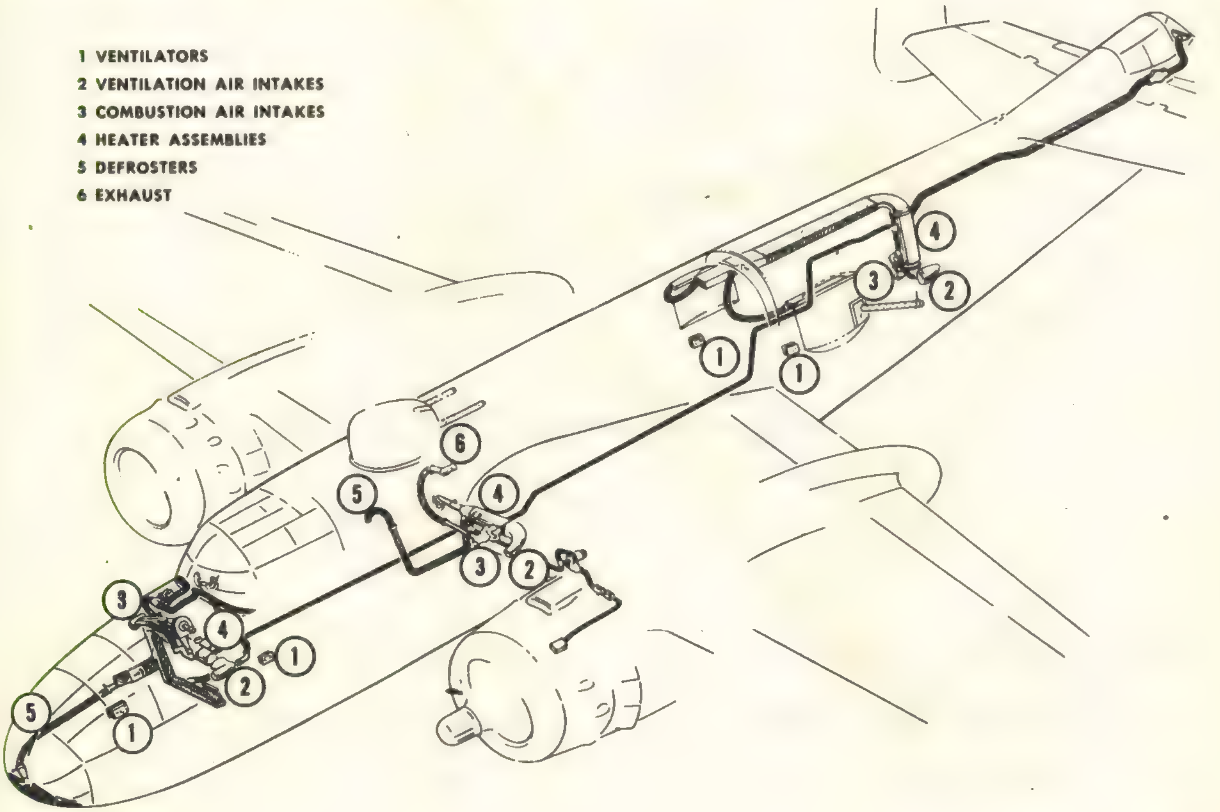
A Surface Combustion heater of 50,000 BTU capacity, is used in each of the three heating systems on late airplanes. The heaters burn gasoline obtained under pressure from the left engine fuel pump. Fuel flow is regulated by a solenoid and a restrictor valve. When the heaters are operated in LOW the restrictor valve reduces the flow to 60% of capacity.

The fuel is vaporized in the combustion chamber of each heater before it is burned. Each heater depends on ram air for operation, except the forward heater, which may be operated on the ground. The air pressure regulator meters the air to the combustion chamber at a constant rate regardless of the increase or decrease of ram air pressure entering the scoop.

The combustion air inlet to the heater is located so that air enters at a tangent to the inside of the combustion chamber. This gives the air a spiral motion and increases the length of travel of the air to several times the length of the combustion chamber. Vaporized fuel joins the spiraling air and is ignited by a glow plug. Combustion proceeds as the fuel and air gradually mix and is completed by the time the mixture reaches the end of the combustion chamber. The result is a highly luminous flame and a rapid transfer of heat by radiation from this flame. The products of combustion flow through the return pass, which provides additional heating surfaces, and are exhausted overboard.

The incoming air is heated as it passes between the combustion chamber and the return pass, and the return pass and the jacket.

On most planes the heating units are removed from the upper turret and the aft compartment heaters and dummy units are installed to allow the heating ducts to be used for ventilation.



LANDING

Temperature inversions are common in winter and the ground air may be 15° to 30°C colder than at altitude. Therefore, take care to avoid excessive cooling when letting down. Lower the landing gear and use flaps to reduce airspeed while descending. Retain considerable power, and if possible, maintain oil temperature above 20°C and cylinder-head temperatures above 150°C. Lower readings than these may result in the engines cutting out or the failure of the engines to respond when the throttles are advanced.

Before approaching for a landing, make sure ice is not jamming the carburetor throttle valve. Test by moving throttle back and forth several times. You may have to use carburetor heat on the approach.

AFTER LANDING

Oil Dilution. To obtain sufficient dilution of the oil to facilitate starting, allow the engine to cool either by idling or stopping after flight, before dilution begins. This will prevent rapid evaporation of the gasoline and insure that the viscosity of the oil has been reduced sufficiently. In most cases you will find that the engines have cooled sufficiently for dilution by the time the airplane reaches the flight line.

Dilute the engines at 1000 rpm for the time indicated below, consistent with the lowest expected air temperature.

Temperature	Time—Minutes	Maximum Allowable Temperatures Cyl. Head	Oil
+4 to —12°C (+40° to +10°F)	6	150°C	50°C
—12 to —29°C (+10° to —20°F)	10	145°C	45°C
—29 to —46°C (—20 to —50°F)	14	140°C	40°C

Warning

UNRELIABLE DILUTION OCCURS AT THESE TEMPERATURES IF THE OIL TANK IS MORE THAN ¾ FULL.

At the completion of the above dilution period, run both engines up to 1700 rpm, continuing dilution, and with propellers in full "INC. RPM" feather and unfeather each propeller through one complete cycle. Operate each propeller governor through one complete cycle. Release dilution switch and decrease engine speed. Stop engines and install engine covers.

Tactical Uses of the B-25

The combat record of the Mitchell has been printed in the newspapers of all the world for every man to see. Little can be added to that story except the developments of the future.

You and your buddies will write that story in the skies of the world.

You have been taught to fly the Mitchell accurately and safely under all conditions. Now you must learn to use the B-25 as a weapon, for that is the ultimate purpose of military flying.

All the skill and determination you can bring to this job will be none too much. How well you learn to punish the enemy and to protect yourself will in the final analysis determine whether you are a successful pilot.

The B-25 has been used for every purpose that need has demanded. Bombing, strafing, torpedoing, and even the evacuation of wounded, are listed in her duty roster. Whatever the need, the B-25 was either ready or quickly converted to do the job.

Her primary duties have been many:

Bombing, both low and medium altitude.

Strafing, with cannon and machine gun.

Smoke missions.

Gunnery, both for defensive and offensive fire.

The following pages illustrate the duties and responsibilities which are yours when using the B-25 as a weapon. They are typical of the actual orders and instructions issued to B-25 crews in training for combat duty.

PREPARING FOR YOUR MISSION

Before a mission is undertaken, the entire crew will be briefed. Upon completion of the mission the entire crew will again report to the S-2 officer for interrogation.

As commander of your airplane, it is your duty to brief your crew before the flight, pointing out to each crew member the specific duties he is expected to perform.

DUTIES OF THE AIRPLANE COMMANDER

1. Coordinates and supervises duties performed by crew members.
2. Pilot and copilot will practice hooded instruments (on day navigational missions), pilotage navigation, or radio navigation on all missions. Either the pilot or copilot will navigate at all times. Contact radio range stations on all navigation missions when possible.
3. Directs bailout, crash landing, and ditching drills on the ground and in flight.
4. Determines that crew members are receiving the necessary training to make them proficient in their assigned duty.
5. Has a complete knowledge of the assigned mission, and the duties of each crew member.
6. Makes proper use of **all** pilot's checklists.
7. Flies at all times in accordance with rules and regulations as outlined in AAF Regulation #60-16, and per scheduled Operations Orders.
8. Sends RON's on X-Country Flights. Understands necessary security measures regarding confidential equipment in the airplane.
9. When remaining overnight away from the home station, determines that crew members are properly housed and fed and are readily available in event takeoff is advanced.
10. Insures that each crew member is properly briefed on the mission to be performed.

COPILOT

1. Is ready to assume the duties of pilot at any time during the flight and acts as **deputy airplane commander.**
2. Aids pilot in his duties and remembers that the time will come when he assumes the responsibilities of airplane commander.
3. Keeps constant check on engine instruments and controls, notifying pilot of any discrepancy.
4. Makes preliminary check of airplane and crew prior to flight.
5. Aids pilot in accomplishing proper checklist.

BOMBARDIER-NAVIGATOR

1. Responsible for knowing exact position of the aircraft at all times.
2. Becomes proficient in his primary duty as bombardier and navigator.
3. Records weather report during mission.
4. Acts as principal observer, recording all pertinent data for S-2.
5. Keeps complete and accurate log of flight.
6. Furnishes radio operator with position reports.
7. Able to assume duties of fire control officer.
8. Checks sights, racks, intervalometer, control panel, driftmeter, and other allied equipment prior to takeoff as per bombardier-navigator's checklist.
9. Familiar with rack malfunctions that may occur during a mission and understands corrective action to be taken.
10. Understands importance of keeping navigation instruments correctly calibrated.

RADIO GUNNER

1. Thoroughly understands all communications equipment in the assigned airplane. Understands failures that are likely to occur and supplies the corrective action.
2. When outside local flying area the radio operator gunner sends position reports to his home base.
3. Contacts AACS stations when unable to contact group ground station.
4. Records all broadcasts weather data and maintains complete log.
5. Assists navigator by taking radio fixes.
6. Furnishes pilot with courses from the D/F station.
7. Checks location of head sets, and operation and condition of all communications equip-

ment as per radio operator's checklist prior to takeoff.

ENGINEER GUNNER

1. Before each flight, checks airplane for proper loading, stowage of life rafts and emergency equipment, and visually inspects the airplane as per engineer's checklist.

2. Has thorough knowledge of the engines and airplane in general. The occasion will arise when the airplane is away from its assigned ground crew and the engineer must be able to perform necessary maintenance and make required inspections.

3. Ready to assume duties of copilot at any time.

4. During flight will complete the engineer's log and practice fire control on all missions. Engineer gunners will also practice turret operation in flight.

ARMORER GUNNER

1. Before flight he is responsible that ammunition is properly loaded and that all gun positions are in working order.

2. On way to target he checks with other crew members to see that guns are properly working (to be simulated during training).

3. Acts as assistant observer, reporting via interphone to pilot any unusual activities and all airplanes they see during flight while on cross-country.

4. Preflights airplane as per armorer gunner's checklist.

The clock system will be used in reporting position of other aircraft seen in flight.

The pilot of an airplane on an individual flight or the leader of a formation flight will make it standard procedure to contact all radio ranges en route to give a position report, and in case of doubtful weather to receive a weather report especially at the field of intended landing.

On cross-country flights, either the armorer-gunner, radio-gunner, or the engineer-gunner will be in the turret at all times.

On low altitude missions, pilot will not fly below altitude specified as minimum for the particular mission being flown.

On all low altitude missions, course will be corrected to avoid flying over towns, cities, and thickly inhabited rural areas.

Some Typical Missions

FORMATION BOMBING

1. This is a day, 6-ship formation bombing mission. A Norden sight will be used in the lead ship on each element and D-8 sights will be used in wing ships. Bombardiers in lead ships will sight for both range and deflection. Bombardiers in wing ships will drop bombs on lead ship.

2. Flight leader will take off at a predetermined time; other ships will take off at 30 second intervals and join formation.

3. After formation has been satisfactorily joined, one circle will be made of the field. During this circle, formation will climb at 170 mph.

4. Flight leader should have an approximate power setting of 32" MP at 2200 rpm. Climb will continue on course until an altitude of 10,000 feet is obtained. High blower will **not** be used and all ships will keep mixture controls in "FULL RICH" position.

5. Upon reaching the desired altitude, the leader will assume that anti-aircraft fire has been encountered, and evasive action will be used.

6. Upon approaching the target, a gentle left turn, diving at 1000 feet per minute onto the target, will be executed. This final turn requires judgment and precision timing on the part of the lead ship. After diving to the correct bombing altitude (8000 feet), and onto the target, the lead ship should be in a position to allow approximately a 20 second bomb run, straight and level. Immediately upon the closing of the bomb bay doors, the leader will again make a left turn, diving at 1000 feet per minute with a bank not to exceed 15 degrees. This dive will be held until 7000 feet altitude is reached. The following data should be strictly observed:

A. The lead ship should climb at 170 MPH, with approximate power settings of 32" MP and 2200 RPM. The wing ships should use 2400 RPM.

B. After altitude is reached, power settings of lead ship should not exceed 1900 RPM and 27" at any time. The wing ships should use at least 2000 RPM.

C. Copilots must be sure that RPM is increased if the MP dictates it.

D. The bombing run should be made at an indicated airspeed of 230 MPH, and upon leaving the target, should not exceed 250 MPH.

E. Wing ships will open bomb bay doors immediately upon seeing doors of lead ship open, and bombs will be dropped on the lead ship. **The Bombardier-Navigator must be quick in releasing bombs after he sees the first bomb leave the lead ship.**

F. Caution must be used by the lead ship at all times. Turns and maneuvers must be gone into gently and slowly.

G. After bombing is completed, flight will return to home base and break up into three-ship elements for landing.

GUNNERY MISSION

1. In this and all ensuing gunnery missions when both ground and water targets are used, extreme care must be exercised to see that the field of fire is clear of other planes.

Instructions for Firing

Ground Targets

A. Five rounds of 75MM ammunition from a range of 2000 yards, firing one round on each approach, plane to turn away from target immediately after firing while using additional evasive action.

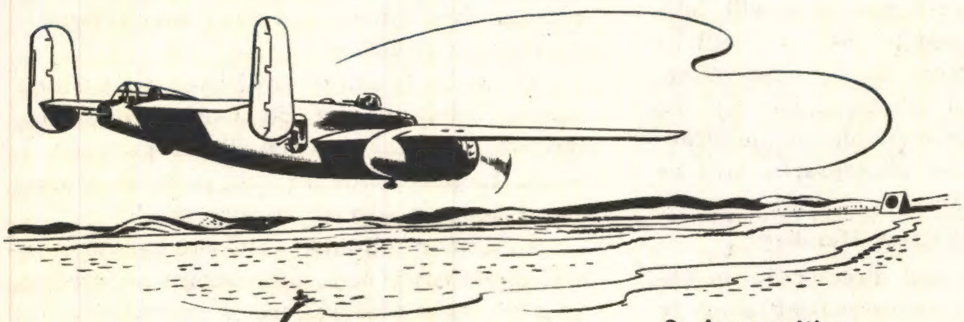
B. Five rounds of 75MM ammunition from a range of 2000 yards, firing one round on each approach, using evasive action before and after reaching the 2000-yard point. Approach from 1000 yards and until passing over the target will be covered with short intermittent bursts of 50-Caliber fire.

Water Targets

A. Eleven rounds of 75MM ammunition from a range of 3000 yards, firing one round on each approach, plane to turn away from target immediately after firing while using additional evasive action.

2. The following course will be flown to and from Gunnery Range at a minimum altitude of 200 feet above the terrain. Flight will be made in 2- or 3-ship formations. Formation will go into column for gunnery.

X Base	To	33°38'N; 80°32'W (Bridge over X River)	39 Miles
33°38'N; 80°32'W	To	34°04'N; 79°56'W (Fork in H River)	46 Miles
34°04'N; 79°56'W	To	34°08'N; 79°13'W (H River, 6 Miles after crossing railroad line)	42 Miles
34°08'N; 79°13'W	To	I.P. 33°39½'N; 79°09½'W	33 Miles
Initial Point	To	Gunnery Control	12 Miles
			172 Miles



3. Ammunition
21 rounds of 75 MM ammunition
1000 rounds of 50-Cal. ammunition

RESTRICTED

CHEMICAL SPRAY MISSION

1. This is a chemical mission, using MR and FS.

2. The plane will be equipped for the mission with a bomb bay chemical spray tank containing MR and two chemical wing tanks—one on each wing—containing FS.

3. The MR target for the mission will be the X Target. The FS target will be the Z target.

4. The MR target is located approximately in the middle of the target area and is marked by an **orange cross in its center.**

5. Chemical tanks will be loaded into the plane. Plane will then be flown to the Z target, making an attack with FS, **using one wing tank,** from an altitude of 100 ft. normally, with the intention of covering the center of the target with a screen of smoke.

6. The plane will then fly to X target, making an attack with MR from an altitude of 150 ft. after inspecting the field to see that the target is in place.

7. The plane will then return to Z target and release the second smoke screen from the remaining FS wing tank.

8. All crew members will be equipped with gas masks while in the performance of this mission. Copilot will wear gas mask beginning 30 seconds before release of chemical until ship has been landed and brought to a stop.

9. This mission will not be flown when the wind velocity is greater than 20 mph.

10. Magnetic course to X target, 197 degrees; distance 50 miles.

11. Special attention should be given to direction of wind. Chemicals should be dropped from a flight path perpendicular to the wind.

12. Mission will be flown at 500 feet above terrain. Towns along route will be avoided.

13. The crew will be interrogated upon return to Home Base as to results of the mission.

DAY NAVIGATION, PHOTO-RECONNAISSANCE, AND INSTRUMENT LET-DOWN MISSION

1. This mission will consist of a controlled ground speed day navigation and photo-reconnaissance mission, at the end of which the pilot will orient himself by the X Radio Range and simulate a let-down to Home Base. If first attempt is unsuccessful, a second orientation and let-down will be accomplished.

2. **Conduct of Mission:**

A. This mission will be briefed by the Squadron S-2. All crew members will take careful notes as directed by S-2, and will be interrogated upon return as to observation. Oblique and pinpoint photographs will be taken. Target maps are available for the localities directed below and photographs will be taken of each given target.

3. **Specific Duties of Crew Members:**

A. Pilot—will aid and direct crew in obtaining observations; give careful attention to best photographic procedures; direct photographs be taken as briefed; and communicate on interphone at all times.

B. Copilot—will take notes on installation noted by himself and pilot, and accomplish all normal copilot duties.

C. Navigator-Bombardier

(1) Will navigate by DR Navigation on a V-P chart except within 10 minutes of target area where pinpoint pilotage will be used on a sectional chart.

(2) Act as observer and perform duties as briefed by S-2.

(3) Maintain and submit navigation log, weather observations, and other data to Squadron Navigation Officer.

D. Radio Operator—will transmit position reports submitted by Bombardier-Navigator, and practice tracking from all gun positions.

E. Engineer-Gunner—will perform all normal duties and also act as observer.

F. Armorer-Gunner—will preflight and install photo equipment; take photos as directed by pilot; make observations of ground activity; and man battle station at all times, taking careful observations and reporting to the pilot all aircraft and ground installations sighted.

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